



Arlington Zoning Board of Appeals

Date: Tuesday, August 3, 2021
Time: 7:30 PM
Location: Conducted by remote participation
Additional Details:

Agenda Items

Administrative Items

1. Remote Participation Details

In accordance with the Governor's Order Suspending Certain Provisions of the Open Meeting Law, G. L. c. 30A, § 20 relating to the COVID-19 emergency, the Arlington Zoning Board of Appeals meetings shall be physically closed to the public to avoid group congregation until further notice. The meeting shall instead be held virtually using Zoom.

Please read Governor Baker's Executive Order Suspending Certain Provision of Open Meeting Law for more information regarding virtual public hearings and meetings: <https://www.mass.gov/doc/open-meeting-law-order-march-12-2020/download>

You are invited to a Zoom meeting.

When: Aug 3, 2021 07:30 PM Eastern Time (US and Canada)

Register in advance for this meeting:

<https://town-arlington-ma-us.zoom.us/join>

After registering, you will receive a confirmation email containing information about joining the meeting.

Meeting ID: 819 3566 7005

Find your local number: <https://town-arlington-ma-us.zoom.us/join>

Dial by Location: 1-646-876-9923 US (New York)

2. Members Vote: Approval of Meeting Minutes - May 13, 2021

Comprehensive Permits

- 3. Thorndike Place**
- 4. Thorndike Place - New Photos**

Meeting Adjourn



Town of Arlington, Massachusetts

Remote Participation Details

Summary:

In accordance with the Governor's Order Suspending Certain Provisions of the Open Meeting Law, G. L. c. 30A, § 20 relating to the COVID-19 emergency, the Arlington Zoning Board of Appeals meetings shall be physically closed to the public to avoid group congregation until further notice. The meeting shall instead be held virtually using Zoom.

Please read Governor Baker's Executive Order Suspending Certain Provision of Open Meeting Law for more information regarding virtual public hearings and meetings: <https://www.mass.gov/doc/open-meeting-law-order-march-12-2020/download>

You are invited to a Zoom meeting.

When: Aug 3, 2021 07:30 PM Eastern Time (US and Canada)

Register in advance for this meeting:

<https://town-arlington-ma-us.zoom.us/meeting/register/tZUkdOyuqDwqGtFS7DxE0VfeOepzTLjgBxeg>

After registering, you will receive a confirmation email containing information about joining the meeting.

Meeting ID: 819 3566 7005

Find your local number: <https://town-arlington-ma-us.zoom.us/j/adNWeNXzLr>

Dial by Location: 1-646-876-9923 US (New York)



Town of Arlington, Massachusetts

Members Vote: Approval of Meeting Minutes - May 13, 2021

ATTACHMENTS:

Type	File Name	Description
▣ Reference Material	Arlington_Meeting_Minutes_May_13__2021-DRAFT.pdf	Arlington Meeting Minutes May 13, 2021-DRAFT

TOWN OF ARLINGTON
ZONING BOARD OF APPEALS
MEETING MINUTES

DRAFT

Date: May 13, 2021

Time: 7:34 PM

Location: Remote Hearing, 959-9632-2295

Members in Attendance: Christian Klein, RA, Chair, Patrick M. Hanlon, Kevin Mills, Stephen Revilak, Roger DuPont, and Aaron Ford.

Attendance: Vincent Lee, Rick Vallarelli, Jennifer Raitt, Paul Haverty, Marta Nover, Bill McGrath, Greg Lucas, Stephanie Kiefer, John Hession, Gwen Noyes, Art Jennifer Watson, Robert Engler, Marta Nover, Arthur Klipfel, III, Scott Thornton, Scott Vlasak, Bob Engler, Kyle Wheeler, Jeanette Cummings, Mark McCabe, Sarah Augood, Sean Keane, Jason Fligg, Michael Quinn, Susan Chapnick, Alice Bennett, Don Seltzer, Florence Murphy, Peter Fiore, Marci Shapiro Ide, Bancroft Poor, Gloria Horwitz, Clarissa Rowe, Heather Keith Lucas, , Loren Bernardi, GM Hakim, Beth Ann Friedman, Susan Stamps, Ann LeRoy, Matt McKinnon, Brooke Olson Blair, Brid Coogan, Florence Murphy, Steve Moore, Alice Bennett, Jeanette Cummings, Loren Bernardi, Michael Quinn, Diego Gianolio, Patience Terry, Elisabeth Carr-Jones, Lisa Fredman, Steve DeCoursey, Calpurnia Roberts, Gary Gryan, Thomas Mason, Pamela Heidell, Anita Gryan, Eva Bitteker, Anna Kukharskyy, Martha Ingols, Brian Rehig, Elaine Lyte, Yenhsi Liu, Alexandra Lee, Tania Fersenheim, Ed Schwartz, Michelle Shortsleeve, Sue Fish, Jennifer Griffith, Alan Jones, Jeff Geller, Barbara Rowland, Andy Forbes, David Barlow, Brian Dowling, Robert DiBiase, Thomas Mason, and Thouis Jones

1. **Chair's Introduction:** Chairman Klein opened the meeting at 7:34 PM. After reading the rules for remote hearings and going over role call attendance, the meeting was underway. Chairman Klein announced that the meeting was being recorded by ACMI and the recording would be available to the public.

COMPREHENSIVE PERMITS:

2. Comprehensive Building Permit for Thorndike Place

At the April 20, 2021 hearing the Applicant requested additional time to prepare design drawings showing the duplex buildings on Dorothy Road and a multi-family unit behind for public review. The revised drawings were submitted on Monday May 10th and posted to the agenda for this meeting.

This evening's discussion will focus on this new proposal from the Applicant and will open with a presentation from the Applicant followed by questions from the Board. After the Board and then members of the public will be able to ask questions and make comments.

Stephanie Kiefer: As the Chairman just stated, at the last hearing the Board had asked the Applicant to consider a design that would reintroduce duplex units along Dorothy Road that had been part of the original project proposal. The Applicant explained how they went back and took a serious look at things, and created a revised concept that was then presented to the Board.

Ms. Kiefer gave a quick overview of the revised concept. The Applicant believes that this new revised concept is consistent with a lot of the feedback that they received. She highlighted a few points: As the Board had requested, they proposed reintroducing townhomes; and also consistent with comments that had been made they would be ownership units. They would still be subject to 40B. Of the six duplex buildings, twelve units, 25 percent of those would be ownership to persons at low-and-moderate income levels. Those would be subject, as previously discussed, to a deed rider that continues on that affordability into the future.

Ms. Kiefer went on to explain that changes that sort of flowed from that was the apartment building that they had on the project site, originally, they had those three tabs that were right on Dorothy Road. They would need to pull that farther back from Dorothy Road to make room for the townhomes. In doing that they took into account what other improvements could they make to address what they had been hearing in the public hearings.

They have reduced the size of the building, so the footprint of the building has been reduced. In addition, from pulling it back from Dorothy Road, it's step-backed further in certain places. The closest portion of the apartment building part of the project to Dorothy Road is about 103 feet, and then the western portion swing's back even farther, 145 feet, and there is a little tab that is 171 feet from Dorothy Road.

In order to give the Board some context to what those numbers mean, she shares it is almost like a back lot and then the footprint of the building is reduced, but also, they are proposing a different program for it. So, it would be senior housing, and it would be assisted and independent living, a mix; 126 units total. Ms. Kiefer refers to her cover letter in the concept plans that were submitted, this is consistent with the master plan on page 88, that reference the need for the aging population of Arlington, and that there would be a shortage in the future. She believes this addresses it two ways: one by keeping it a rental you have the ability for Arlington's residents to sort of age in place. You have someone coming into an independent living then as their needs progress they may need to move to the assisted living side. They are able to stay in the same community with friends and family within Arlington.

In addition to providing that need, the revised program also responds to the concerns about the amount of parking on the site. Assisted and independent living tends to generate less traffic and therefore the needs for parking are greatly reduced. Scott Thornton was there to explain how the ITE parking scenario works out.

The overall parking count would be 95 or 96 units, 85 within the garage parking, and then only 10 surface parking spaces. It greatly reduces that and she goes on to explain another benefit is that it reduces the impervious surface so that the western side of the property becomes open space. Where they had that western surface lot and then a children's play lot, that would now be available for green open space, gardens, lawns that type of thing.

Ms. Kiefer explains that they made a progression chart which she has Mr. Thornton put up on the screen so the Board could see how Thorndike Place has changed in the course of the public hearings.

The progression chart summarizes the history of the proposal. The original proposal from mid-2020 had 219 apartments and 12 units in duplexes on Dorothy Road with a 207 multi-family apartment building behind that. The proposal was then revised in the fall of 2020, when it was pared down to just multi-family, and it was reduced down to 172 units. The current proposal that is being presented has a total of 138 units; 12 duplex style fronting on Dorothy Road in six buildings; and behind it, a 126-unit senior living; assisted and independent living. Twenty-five percent of the units will be affordable rental units.

Ms. Kiefer goes on to explain that the largest change is the amount of parking would be required. Originally when they had the townhouses and the much larger multi-family building, it included 309 parking spaces, 178 of those were garaged with 131 surface spaces. The previous plan that they had been discussing had 178 garage and 15 surface, and then the plan that was currently being presented is a total of 96 total parking spaces, 86 garaged and 10 surface parking spaces.

Continuing on, Ms. Kiefer shows the layout of the project originally had those townhomes on Dorothy, and then had the two-winged multi-family building. The 172 units just had those three front tabs going towards Dorothy, a long spine that was about 415 feet in length, and then some tabs going off to the rear. The closest portion of that multi-family building was 25 feet off of Dorothy Road.

In the plan they are currently proposing, those duplex homes come back in. They are right on Dorothy Road; they present that neighborhood feel that they heard was important to the Board and the neighbors. In addition, they also help to provide a buffer for the senior living apartment building that is going to be behind that. The apartment building has been moved further back off of Dorothy Road. Not only is there now a buffer, but there is a reduced distance from the senior living building which helps with the massing scale.

Ms. Kiefer now moved onto the ground water and flood plain design. The garage was at elevation 2.83, and the first-floor of the 172 unit multi-family building is at elevation 13. She says that John will go through this in much

more detail. Ms. Kiefer points to a slide showing the garage level which they raised it up, so it is going to be at elevation 6. It is going to be above the water table. The first-floor elevation for the senior living will be at elevation 16. The duplex townhomes closer to Dorothy Road will be at elevation 12. There is going to be no underground garage parking, instead there is just driveway and a carport between the two.

Ms. Kiefer finished with, the open space amenities. The prior design had a children's play lot, and then it had the courtyards in the rear, and one in the front. The revised design, because the footprint of the senior living is smaller, and the parking requirements are much reduced, they have the ability to make the western side space really nice with the open space with gardens, lawn, benches which are all concepts for now of what is possible. Then there is a courtyard to the rear of the building. When you enter the property and are going into the senior living drop off area it is going to be treelined. It is going to be a little boulevard for guests and visitors. The current plan has much more open space amenities than the prior design.

Ms. Kiefer turns the presentation over to Gwen Noyes, Architect and Developer.

Gwen Noyes: Ms. Noyes takes over the presentation and takes everyone on a tour of the site plan, through a slide show.

Ms. Noyes points out that the proposed duplexes are smaller than the ones across the street. Each of the townhouses has a small yard in the front of their homes, and driveways that allow access to a carport or a garage. They haven't decided exactly about that, but there is room for one car in the garage or carport and one on the driveway. The elevation of the driveway is 11 feet so there is no danger of flooding. There is a small backyard on the side where the assisted living is, but it is a private little backyard and there is a roof deck also included with all these townhouses. They are built to have three bedrooms plus a den. They probably will have a basement, but it is not necessarily the whole house, and it certainly is not vulnerable to flooding, because there would be no way into it that would be below a 12-foot elevation.

Going down Dorothy Road to the entrance of where the new project would be, the assisted living building. They are showing a buffer planting area between

Comment [cmk1]: This is confusing, as the driveway is at 11.

the property line and the house next door. So there would be room for a screen there. As Ms. Kiefer mentioned this area, on the last plan, was designated a parking area and a playground area. What they are showing on the slide is a variety of uses that could be put in. They are showing four parking spaces that are adjacent to it.

Continuing from the driveway, entry drive, a left turn into the tree-lined drive that would go up to the entry of the facility. She is showing where the entry would be. There is guest parking on the way in, the drawing is showing it angled but it's been discussed with John that it would be much better at 90-degree parking. This is also where deliveries and movers, trash removal would take place.

The entry to the garage is now at elevation 6, and there would be fewer cars on this plan. This would be where staff and residents would park. She points out that there could be solar panels on the roof as well as it could be a blue roof with water retention, depending on their studies. This would be a very energy efficient green building probably all electric, and she explains that was something the team tried to incorporate into the designs.

There is a fire road and a walking path. The fire road is in the same place as it was in the earlier the design. The footprint of the building is largely the same as there are just minor changes. In regard to all the wetland's considerations and setbacks for flood plain and so on, there are very minimal tweaks that have happened. They are planning to do woodland restoration. She has been told that the width of the road is precisely what is on the plans for Arlington. It shows the new trees along the street and showing a seven-year growth, they would not be putting in large trees at the beginning, but they would grow. And they have a slight variation in the plans between the duplexes so that it isn't the same exact thing.

With this she turns the presentation over to Scott Vlasek (architect) and Arthur Klipfel (architect/developer).

Scott Vlasek: Mr. Vlasek talks about the townhouses along the road, pointing it out on the screen. They are making an effort to use residential forms, residential vocabulary that will fit into the neighborhood. He's trying to break

up the facades with various trims, overhangs, fenestration, and different color accent siding so that these units won't appear the same. The units inside will, however, be very similar. There is quite a bit of landscaping along the road and plantings along the property lines that will further help to screen the four-story building behind.

Arthur Klipfel Mr. Klipfel adds that the townhouses themselves are typical for the neighborhood, they are at 2 ½ stories, there is one bedroom upstairs and two bedrooms and a study on the second floor, and the living, dining and kitchen on the first floor. Each building has two separate units in it with two completely separate entrances. The back deck that Ms. Noyes mentioned would be on the third level.

Scott Vlasek: Mr. Vlasek shows another slide and mentions that the carports would be open on the front and open on the back if carports are chosen over garages. The next slide goes over a more technical side of the materials that could be used. They could use cementitious siding, or similar siding that would be low to no maintenance. They would use different colors and different textures and patterns to break up the façade. Mr. Vlasek points out that someone walking along Dorothy Road and standing outside of the property on the other side of the street, they would not be able to see the senior apartment building over the top of the duplexes/townhomes. The whole building has been raised in order to move the garage level from 2.83' to elevation 6.'

Arthur Klipfel: Mr. Klipfel goes on to explain that there will be a large porch, 62' x 13', in the rear south side of the apartment. The apartment will have a commercial kitchen, a dining area, and common spaces. The independent living side might need offices, it is not yet designed. They have an outside architect that is consulting due to his expertise that will help design the senior and assisted living building. The delivery area will have a truck lift and possibly a trash room and more. The assisted and independent living units are the same size, but the assisted living portion needs more common areas. There would be studio units, one-bedroom units and a few two-bedroom units. There possibly could be some memory units which would be the same size as the assisted living.

Gwen Noyes: Ms. Noyes states that the footprint is 32,708 square feet.

John Hession (Civil Engineer): Mr. Hession now takes over the presentation and points out the emergency vehicle access road and pedestrian path surrounds the building on three sides the east, south and west sides. It is in the same location that was shown on the 172-unit single building multi-family. So, they really locked that in, and treated it as a limit of work, and kept this revised development program within that same envelope as to not encroach any closer to the wetlands or buffer or AURA.

Mr. Hession did want to highlight: This plan and the 172-unit plan that proceeded, that dated back to November, has no work proposed in wetlands either bordering vegetative wetlands, or isolated vegetative wetlands. He just wanted to make that point clear. It's been discussed that this project is still in wetlands or there is work in the wetlands. This project has no or the 172-unit or this revised version proposes no work within BVW or IVW. Because they kept the limit work to the original location of the emergency vehicle access drive, there is no additional permanent improvements proposed within the 100-foot buffer for the 100-foot AURA under the Arlington Wetlands Bylaw.

They had that some limited portion of the building proposed in a 172-unit proposal and the emergency access drive in that portion of the AURA. Then when he confirmed the existence of the isolated vegetative wetlands on the east side the emergency vehicle access, a portion of the access is in the outer limits of the AURA.

Another point Mr. Hession raised is the 172-unit multi-family building, it had the footprint of the building but the footprint of the garage actually extended beyond the footprint of the residential portion of the building. The three courtyards, the two in the front and the one in the rear southwest corner were all courtyards over the garage. They were essentially impervious areas. In the present plan the garage footprint is limited to the footprint of the senior living building. Anything on the site plan that is not either a driveway, parking spaces or shaded in gray on the slide, which is the senior living building and the duplex buildings, is pervious areas. So there is a significant reduction in the total impervious surface areas with this revised development program with the

reduction in the density and the reduction in the impervious area, it really opens up a lot of flexibility and a lot of opportunity to provide more options to the storm water management design.

Storm water management again with the reduction in impervious area, is not going to be as much of a challenge as it was on the 172-unit proposal. We demonstrated with BETAs peer review that we were able to accomplish that. With this plan, there is a lot more flexibility and opportunity to do some different things.

Mr. Hession goes on state that the last thing he wanted to mention on that is also by raising the senior living building, they're raising the ground around it which provides some more separation from ground water which again gives them more flexibility to look at ways to address that storm water management.

In summary on that, Mr. Hession thinks that they demonstrated that on the larger 172-units they were able to meet the storm water requirements and here although this is a really conceptual level presentation, he can confidently say that with this program the civil engineering challenge of that just got significantly easier to accomplish.

Arthur Klipfel: Mr. Klipfel states they made a significant decision here to move to senior housing. The decision was based on what they were hearing loud and clear and even experienced the traffic on Lake Street at peak hours is very challenging to say the least. Assisted living tenants, independent living people most likely would not be driving, and if they did, probably not at peak hours. These are all things that are hard to verify with numbers and charts, but it makes sense. They are going to work on that to try to be a bit more definitive about that. The staff would have the ability to use the Red Line. Overall, they are making a major move in trying to lessen the traffic and parking impacts.

Scott Thornton: Scott Thornton, a traffic engineer with Vanasse and Associates introduces himself. He says that common sense will tell you that 126 units senior housing complex will have a smaller traffic and parking impact than 172-unit apartment building. This development has fewer units, less parking, and a different type of resident profile. They are still working through the numbers, and they did go through the parking calculations; they will be able

to accommodate the parking requirements for the senior housing within the garage under the building, with additional surface spaces for visitors. Based on ITE parking generation data, they need between 64 and 80 spaces for the two uses. As was indicated earlier there is about 86 spaces in the garage so they can easily accommodate that demand. That is also consistent for the assisted living component that is consistent with the town bylaw which requires .4 spaces per unit. They have another 10 surfaces spaces that can be used for visitors. They feel they can accommodate the parking demands for the project.

He goes on to that in terms of the traffic calculations, and they are still finalizing those numbers, in order to generate the traffic volumes that were anticipating with the apartment complex they were reliant on a pretty aggressive TDM program. Most of the travel associated with senior housing or seniors in housing is discretionary in terms of the time of travel. Some IT data indicates that the assisted living components have their peak periods in the middle of the day, rather than during peak hours, and that is really visitors and staff.

Mr. Thornton turns it back over to Stephanie Kiefer.

Stephanie Kiefer: Ms. Kiefer states she wants to thank the Board for challenging them at the last hearing to ask them to look back to reintroducing the duplex because she thinks it had them look at a number of things. She also went on to thank the Board for its consideration of their presentation of this alternative concept this evening.

Ms. Kiefer goes over what she believes to be the five or six key points:

- 1) The request to bringing back duplexes. They think that they can successfully do that, and it provides a consistency with the neighborhood and the scale. It provides buffering for the senior assisted living. It also does provide what they heard from a number of people that they wanted the kind of the streetscape that they were used to on the other side of Dorothy Road.
- 2) The amount of impervious area on this revised plan is significantly reduced from the original plan. They now have the whole western side that is available for open space now that creates a very nice opportunity there.

- 3) The buildings for the four-story senior assisted living building are completely out of the water table. The garage is at elevation 6, and the first-floor elevation 16. And then duplexes on the front of the street they're at elevation 12, and the road itself is somewhere around 9 ½ or 10.
- 4) They think that the decrease in density from 138 to 126 being senior and assisted living, along with the reduction in parking, gives them a reduction in base generation.
- 5) Then the size of the apartment building itself has been reduced.

Those are some of the key features. A lot more of the subfeatures were presented through others. They are happy to answer any questions the Board may have and requested the Board to support this revised concept plan at the end of the evening's hearing. She also requested the Board take a straw poll to see where the Board is on this. If there is support for, they will continue down this path. If there is not support for this plan, they would go back to the 172-unit apartment plan.

That brings the presentation for the Revised Draft for Thorndike Place to a close.

Chairman Klein: Chairman Klein thanked everyone for a very thorough explanation of all aspects of this project where it is a such a departure from what the Board was looking at before.

Do members of the Board they have any specific questions they would like to ask at this time?

Patrick Hanlon: Mr. Hanlon wanted to go back to the question of how it is that changing over to the combination of the duplexes and senior assisted living and independent living how that works along with the reservation of the affordable units? His understanding is you are talking about three of those units being affordable with a deed restriction which is essentially perpetual; is that correct?

Stephanie Kiefer & Arthur Klipfel: Yes, as I understand it.

Patrick Hanlon: Mr. Hanlon asks what is the level of income affordability for ownership?

Stephanie Kiefer: It's 80 percent.

Arthur Klipfel: It is the same for rental and home ownership.

Patrick Hanlon: Mr. Hanlon asks if 25 percent of both the independent and assisted living units are affordable at the 80 percent level?

Stephanie Kiefer: That is correct.

Patrick Hanlon: Mr. Hanlon continues, is that split proportionately between the assisted living units and the independent living units? How does that work out?

Stephanie Kiefer: Ms. Kiefer responds that she believes that it is, but Bob Engler if you're on the line can you field that.

Bob Engler: Mr. Engler, consultant to the applicant, says it is the same thing as one, two and three bedrooms you have 25 percent in each category. In this case the category is assisted and independent, so your 25 percent is in both areas.

Patrick Hanlon: Mr. Hanlon just to make sure it is clear on the record, the restrictions there are essential perpetual; is that correct?

Stephanie Kiefer: Ms. Kiefer states that on a rental you have it built into it. When you have home ownership it goes with the deeds, there is a regulatory agreement that provides for the continued affordability.

Patrick Hanlon: Mr. Hanlon asks over what time does that rental agreement provide for affordability?

Bob Engler: Mr. Engler explains that it's in perpetuity basically because the regulations state that you have to prove that there was no further need for affordable housing to get released from that stipulation. So in effect it is staying on forever.

Patrick Hanlon: Mr. Hanlon has a question about the townhouses regarding the half stories: Have you looked at our bylaw to see how a half story is calculated or

is that a generic statement that would comply with the half story requirement in our bylaw?

Stephanie Kiefer: Ms. Kiefer responds she would need to double check what the bylaw said, the version that is applicable to this project. If it didn't comply, we would request a waiver of it. They haven't updated any waiver lists.

Patrick Hanlon: Mr. Hanlon asks on the height and feet, did he read the chart correctly that the ridge-line of the duplexes is 40 feet high?

Stephanie Kiefer: Yes, it is 40 feet. The highest peak is 40 feet.

Patrick Hanlon: Mr. Hanlon states, the bylaw, if he's not mistaken, also has a maximum height of 35 feet.

Chairman Klein: Chairman Klein states that would depend on the zone district and I believe this is a PUD district which has a higher threshold.

Patrick Hanlon: Mr. Hanlon, so is the 40 consistent or not consistent with the underlining zoning now?

Chairman Klein: Those are all under the PUD district and I don't recall the maximum number off the top of my head.

Stephanie Kiefer: Ms. Kiefer steps in and states it is 80 feet, but for when it's residential it is 5 stories is the tallest. So, everything is well below that five-story limit.

Patrick Hanlon: Mr. Hanlon states the rest of the neighborhood is not PUD, right? So they're probably at 35 feet while this is 40 feet. So if you looked at the site plan these look to be narrower and taller than the duplexes across the street; is that correct?

Stephanie Kiefer: Yes.

Patrick Hanlon: Mr. Hanlon says later when we do the straw polling, he feels that this is a very positive change and is very pleased with it.

Stephen Revilak: Mr. Revilak has a few questions. He just wants to confirm what is the surface elevation of Dorothy Street?

Stephanie Kiefer: Ms. Kiefer believes it is 9 ½ feet.

Stephen Revilak: He also assumes the district regulations for PUD do not include assisted living as a use? So, I presume that would be coming in a waiver at some point?

Stephanie Kiefer: Yes.

Stephen Revilak: Mr. Revilak asks that slide 8 or 11 be pulled up. He wants to see where the rear property line of the duplexes will be, roughly.

Stephanie Kiefer: Ms. Kiefer points out that it will be 10 feet back from the rear of the building.

Stephen Revilak: Okay. So, a ten-foot rear yard. And he notes that leaves a little bit of a buffer between the duplex rear yard and the senior building. And he was wondering what kind of screening they might be contemplating.

Stephanie Kiefer: Ms. Kiefer responds and asks to go back to the site plan, what they have thought about, and the landscaper is not totally engaged, but there could be a 6' fence at the back of the small yard. What they are proposing here is really it's a landscape buffer. They feel you can do quite a lot with the space that is there in terms of having a nice planting area and then the walk. She believes it will be a buffer area that will be landscaped.

Stephen Revilak: Mr. Revilak referring to the sketch states he saw a bike on the sketch, and wants to know whether he should assume the blue bike station is no longer necessary or no longer contemplated?

Gwen Noyes: Ms. Noyes fields this question. She thinks this population would not be serious bicycle riders. She would encourage it still. It occurs to her that she didn't say it earlier, but she would love to see adult tricycles that would allow people to do a little shopping, and still have a degree of stability along the bike path.

Stephen Revilak: Mr. Revilak is aware for normal apartment buildings comprehensive permit projects usually have a 10 percent requirement for three bedrooms, and I assume for this use that is not applicable?

Gwen Noyes: That is correct.

Stephen Revilak: I presume we are still planning to use aggregate piles?

Gwen Noyes: Yes, if they use piles at all.

Stephen Revilak: Mr. Revilak states he knows that this is very early in the process but he was going to ask a couple of questions about how the new building would affect the drainage plan, and I think Mr. Hession partially answered them at least in the sense that the reduction in impervious surface makes the job easier. He was wondering if any of our colleagues from Beta can comment on that?

Bill McGrath: Mr. McGrath with Beta thinks in general a reduction of impervious space is going to be a benefit to try to manage stormwater on the site. They certainly still have to see the layout and how the footprint of that stormwater management system fits, but he agrees in general it is a positive in terms of trying to manager stormwater.

Aaron Ford: Mr. Ford feels that all the changes are very positive and he commends them all on what they've done. He's very pleased.

One of the major concerns he still has is the construction in the buffer zone of the wetlands in particular the bottom left corner of the building. He would like to know if it is possible to slide the building up a little bit or that wing up, so they are not constructing in that buffer on the left?

Art Klipfel: Mr. Klipfel explains that it is a challenge because of the layout of the parking below, that offset is about 42 feet, which is a parking dimension that is one space plus one aisle, and that's what established that. We can look into it but they might have to sacrifice parking spaces. He believes that 20 feet is a pretty safe dimension, they don't want to push the duplexes any closer to the street.

Gwen Noyes: Ms. Noyes stated that this is the way it was in the previous plan, and they would like to keep it this way.

John Hession: Mr. Hession wanted to point out this is the same impact that they have been working with into that AURA a couple hundred square feet basically since November when they submitted the revised plans, and the updated confirmed wetlands delineation. He thinks it is important to note too that construction in the outer limit of the AURA is not prohibited under the wetland bylaws.

Mr. Hession asked to look at the colored sketch, what is labelled down at the bottom of the drawing there “woodland restoration.” The thought and the idea is the commitment to remove invasive species, and remove the impacts of the homeless population that has been in and out on this property for years. There would be an opportunity to actually improve the AURA in that with a restoration in the area where they have that very limited building impact. He thinks if they aren’t able to move it, he does believe they have taken it into close consideration and looked at ways that could improve the values of that AURA with that restoration, with that invasive species management and woodland restoration.

Aaron Ford: Mr. Ford thinks that they are presenting a concept that is significantly better than what we had, but he would like to them to take a look to see what we could do because he has concerns about losing any wetlands or even the buffer zone of the wetlands.

Kevin Mills: Mr. Mills thanked the Applicant for an excellent revision of the plan and a lot of hard work in a short amount of time. He thinks it was a very good idea not including garages underground for the six duplexes. He believes raising the grade around the duplexes and the main building is very key. The garage is now above the water table which should intuitively cause less disruption to the water flow of the site and of the whole area towards Alewife Brook. He is also appreciative that it does address senior housing issues which is a key demographic to take care of.

Mr. Mills does have a question about the driveways with the six duplexes. The last duplex looks like it has the driveway coming in off the driveway of the apartments; is that true?

Gwen Noyes: Ms. Noyes responds, yes, that is correct. In order to use the space, have less pavement, they brought it in off the entry drive, and that is true on the other end also.

Kevin Mills: Mr. Mills knowing that they are really at the conceptual stage now, so many questions would go unanswered at this time, but people will be expecting answers to the questions of: How many staff? How are they going to get there? Where are they going to park? Where are they going to be on the site? What delivery schedules would be? And the impact on traffic? He does state though this will be an improvement over the original.

Roger Dupont: Mr. Dupont states he has a couple of questions about what the dimensional changes really are.

Mr. Dupont believes at the 172-unit stage, the total square footage of all four floors was 195,000 square feet and the footprint was around 54.5 almost. Today for the back building, he thinks he's looking at 32,708 per floor, and that is about 138.32. So there's a difference between those two of almost 64,000 square feet. He wants to know what the combined footprint is for the duplex units in the front?

Gwen Noyes: Ms. Noyes responds it is 6 x 1600. That is 40 x 40 is 1600 for one entire duplex. Then there are six of them which makes 9,600 square feet. The carport is not included and that would add to it.

Roger Dupont: Mr. Dupont inquired about a comment made by Mr. Hession about raising of the building. From the earlier meeting, the height above the street was 47 feet, and looking at these plans, I believe it is 60 feet now; is that correct?

Scott Thornton: Mr. Thornton responded that the roof is 50.5 feet above the elevation of the street.

Roger Dupont: Mr. Dupont turned to Mr. Klipfel, and asked if the building is divided into sections for independent living and assisted living?

Arthur Klipfel: Yes, that is correct. This still needs to be fine-tuned.

Roger Dupont: Mr. Dupont is curious, what happens if somebody needs to move from independent living to a more assisted living situation is that something that could happen?

Arthur Klipfel: Mr. Klipfel responded, that is actually something that happens very often as we understand. You just change rooms you would go to the other side. You would go into the assisted living side of the building.

Roger Dupont: Mr. Dupont stated that he understood that, but if you have the same percentages of affordable units for the assisted and independent. And if somebody had an affordable independent living unit and they needed to have assisted care, they would have to wait for a unit on the other side to become available in order to qualify for an assisted living unit?

Gwen Noyes: Ms. Noyes says that is a management question with something they have not had a lot of experience with but thought that Mr. Engler might be able to answer that question.

Bob Engler: Mr. Engler explained that the way it works is the resident can move into an assisted living unit whether it is a market or affordable, whatever the first turnover is, and if that affordable unit takes over from a market unit, then the next unit that opens on the assisted side has to be market. They keep the same ratio, but they don't stop somebody from moving.

Roger Dupont: Mr. Dupont says he is interested in seeing what the difference is in the traffic calculations because I believe your assumptions are different.

Arthur Klipfel: Mr. Klipfel noted there is one thing that wasn't mentioned that came up, there are more deliveries than we would have had with the multi-family building. But they do expect delivery people coming in the middle of the day, outside of peak traffic hours. Also, they are aware that with the assisted living not only will there be more deliveries, but also more medical personnel and emergency situations that would add to traffic as well.

Gwen Noyes: One thing from the other assisted living building we worked on in Lower Mills one of the reasons we located it there was to be close to a Red Line T stop. Many of the staff do use the T, and that will help with traffic. A nice path through the woods to the T stop would also be helpful, but that is just wishful thinking at the moment.

Chairman Klein: The Chairman inquired if there were any additional questions from the Board?

Hearing none, Chairman Klein opens the meeting for public comments on the revised design for the proposed project.

The Chairman goes over the rules and policies for how public comments work, then opens the floor to public comments and questions.

Susan Chapnick: Ms. Chapnick introduces herself as the Conversation Commission Chair in the Town of Arlington. She says she appreciates the thoroughness of the explanation of the changes to the plan. She also appreciates that the changes have tried not to impact the wetland resource areas or the flood plain. She understands that the flood plain is impacted greater than the previous plans, however the Applicant has said that the compensatory storage at the level of 2:1 can still be realized in the area proposed previously. That is something she would like to review, but that is good news.

As in terms of the encroachment of the new building footprint into the outside of the AURA, she wanted to remind everyone online that in the Town of Arlington the buffer zone is a resource area. So, it is considered a wetland resource area, so that is an impact. Sometimes the local bylaw and implementing regulations do allow for work within buffer zones with mitigation. Ms. Chapnick stated she believes the previous plan did not have any encroachment of the building on the south side into the resource area. She believes John misstated that. Previously the roadway impinged, but the building did not. She states she is disappointed, but understands there has to be some give and take.

John Hession: Mr. Hession says that on the previous plan the basement garage level it did encroach on the AURA, but not the residential living spaces above. The garage footprint hasn't changed. They just have living space over it now.

Susan Chapnick: Ms. Chapnick says that she was looking at Sheet C105 01/21/2021 and that did not correctly depict where that limit of work was in relation to the AURA? She states that was the plan that the conservation

commission reviewed in relation to what resource areas, and she believes it is the same plan that BETA group also reviewed.

Gwen Noyes: Ms. Noyes says it has been consistently shown that way, although it may not have been obvious. The last drawing for the previous plan showed a walk from the deck across in front of the units on the roof of the garage and then stepping down to the children's play area.

Susan Chapnick: Ms. Chapnick believes that was misrepresented because it did not include the underground parking if that is what they are saying now, which was not clear to the Conservation Commission and may or may not been clear to Beta at that time.

(Additional discussion, back and forth Ms. Chapnick and Mr. Hession.)

Chairman Klein: Mr. Chairman decides to move on and come back to that discussion when Mr. Hession has the document referenced.

Marta Nover: Ms. Nover, from BETA, says that she was able to pull up the plan that Ms. Chapnick referred to and states it definitely does not – it shows the footprint of the building outside of the AURA. It is really not clear that the parking was underneath it. Ms. Nover says, they will take a look at the next set of plans.

Matt McKinnon (9 Little John Street): Mr. McKinnon wanted to know why the decision was made to not include underground parking garages, and basements for the duplexes and townhomes?

Arthur Klipfel: Mr. Klipfel responds that they're contemplating half or full basements.

Matt McKinnon: Mr. McKinnon wants to know why aren't they taking this and moving it above ground like they are doing with the townhomes?

Chairman Klein: Mr. Chairman tries to clarify Mr. McKinnon's question. Is he asking why the apartment isn't raised in elevation so that it's parking doesn't need to be below grade? Mr. McKinnon says, yes, that is what he is asking.

Arthur Klipfel: There are many buildings of this type that have no garage.

Matt McKinnon: Mr. McKinnon chimes in what about basements, and asks why are there no basements?

Chairman Klein: Mr. Klein states to say that the duplexes do have basements they just don't have --

Matt McKinnon: Mr. McKinnon interrupts stating they were optional basements. He wants to know whether the basements are optional or not?

Arthur Klipfel: Mr. Klipfel states due to flooding concerns, they feel a half basement would make more sense.

Gwen Noyes: Ms. Noyes explains this is an early enough design that the word "optional" was a misspoken, they have not made a decision on how large the basements should be. They do believe there is value in having a basement, but it doesn't necessarily need to be a full basement. They don't want the basement to flood which is a concern.

Matt McKinnon: Mr. McKinnon wants to know if a basement is subject to flooding, then why are they putting cars in an underground parking garage?

Gwen Noyes: Ms. Noyes explained that in the area where they have the garage, it's very close to the grade level, the grade beyond the garage is about 7.

Matt McKinnon: Mr. McKinnon cuts in and says, but it is on top of the 100-foot AURA.

Patrick Hanlon: Mr. Hanlon requests that the Chairman advise Mr. McKinnon to let people finish their answers without interruption.

Matt McKinnon: Mr. McKinnon apologizes and states he just wants to get clear answers.

Arthur Klipfel: Mr., Klipfel tries to explain that there are a lot of different things that weigh into the positioning of a building. In this case we were trying to keep the building as low as possible, as dry as possible, and as you mentioned at the beginning of your statement there is ways to control this with drains, and drainage and pumps and all that kind of stuff. I don't think we need that here, but it is

something that if you can do what we are doing with the townhouses and have no ramps going down to the garage that is preferable, but sometimes as a compromise that is what you have to do.

Gwen Noyes: Ms. Noyes explains that the means of controlling grades, drainage and so on for a garage that has a one main entry and 86 parking spaces is much more manageable than managing drainage car- by -car.

Heather Keith-Lucas (10 Mott Street): Ms. Keith-Lucas expresses that she appreciates the concessions that the Applicant has made, and the return of the townhomes which are more appropriate in the neighborhood. She is still concerned about the flooding, and recognizes that this proposal is still in its infancy for the Applicant, so I do hope the ZBA can have more information about the comprehensive system of water drainage that will be included in their plans. She is concerned with the duplex style homes and water going through the front doors of these homes. She would like to learn more about how the water is going to flow from Dorothy Road into the properties.

Ms. Keith-Lucas has concerns about the underground parking for the independent and assisted living facilities. She wants to know is there a time limit for the property use or is the Applicant's proposal a commitment to permanent property use for independent and assisted living? She also would like to know how meal preparation is handled for the assisted living residents as she does not see a dining hall or kitchen in the plans.

Chairman Klein: Mr. Chairman responds to Ms. Kiefer in regards to the time limit of the use of the building. He assumes that if the use of the building is included in the decision for 40B, it is for the length the agreement is in place. It would need to remain.

Stephanie Kiefer: Ms. Kiefer responds, that is correct. If at a later date someone wants to change it, they would have to come before the ZBA, as the change would have to be built into the comprehensive permit. It's not like it can just change.

In regards to the second question, she explains that when Art was going through just the schematic of the first floor, he was showing the area that would be the commercial kitchen then the dining room for the assisted living. If the Board

wants us to continue down this design concept, we can provide more information in terms of how the interior layout goes. The first-floor schematic is very basic and as we go through this concept, we can go more into details on this and change and update.

Heather Keith-Lucas: Ms. Keith-Lucas has some questions for consideration by the ZBA. Given the nature of the assisted living facilities and independent, ensuring that we have enough access for emergency vehicles, and also good site lines in terms of the curbs in the road as well. She also echoed other statements that were made about not having any development in or near the buffer zone. That may require some additional modifications to the footprint of the building.

Don Seltzer (Irving Street. Mr. Seltzer is very pleased with the changes in this version, that putting in senior housing is an excellent improvement. This will certainly have some positive affect on the traffic particularly on peak hours.

He does have a few comments regarding the handicap parking spaces, they meet the minimum state and federal regulations for a parking garage of this size, but it's not realistic for a 126-unit facility for seniors. He strongly urges that the number of accessible spaces in the garage be increased.

Due to the fact that the duplexes on Dorothy Road are so tall, Mr. Seltzer does not feel they fit in with the character of the neighborhood.

His major remaining concern is the impact of street flooding on Dorothy Road. There is a provision in the bylaws Title 5 Section 11 that requires the posting of a bond to protect against flooding problems arising in the first five years, and he would like to ask is this bylaw provision among those that are being waived for this project?

Stephanie Kiefer: Ms. Kiefer says she doesn't know, and she will look into it.

Marci Shapiro-Ide (152 Lake Street): Ms. Shapiro-Ide and her husband have some comments. In general, she is still against anything being built here, that would be her first preference. However, she is glad to see the townhouses back, she does think they are still a little too large, and would like to see them shrunk down a little. Ms. Shapiro-Ide states she works with seniors and works with senior

housing a lot, and wonders if they can increase the number of affordable units. And although 40B's call for a minimum of 25 percent of affordable units, there isn't enough of affordable housing and she doesn't think 25 percent is enough. She would like to ask the developers to consider making it 100 percent independent living and at least 50 percent affordable. She also asks if preference can be given to local residents.

Paul Haverty: Mr. Haverty, counsel for the town, states the Board can impose a condition for local preference up to 70 percent, but ultimately, it's the subsidizing agency that determines the amount of local preference that can be allowed.

Patrick Hanlon: Mr. Hanlon adds that when we get to the discussion of this, local preferences are really quite controversial. When you have a local preference in a town that is racially as little diverse as our town is, you're essentially giving a preference to white people. That is why we have the 70 percent, and is why you can't go above that. The Board should think long and hard before asking for a local preference requirement.

Chairman Klein: Mr. Chairman asks the Applicant to consider the question about increasing the percentage of affordable units. He realizes it is not a question that can be answered on the spot.

Stephanie Kiefer: Mr. Kiefer states they will take that under consideration.

Nicholas Ide (152 Lake Street): Mr. Ide wanted to thank the Applicant for the new draft, he sees that some alternate thought has gone into it, and it is very much appreciated.

Mr. Ide has two main comments and a few small questions. The first is on the senior housing. He thinks that saying a lot of people will take the Red Line is making a lot of assumptions about where the workers come from. There are many places such as Lexington or Woburn or Burlington where people would not take the Red Line. So, you're assuming everyone will be coming from downtown or Cambridge and that seems to be a little bit of a stretch. The other thing is even if they do that it is a 16-minute walk to the train station, and he thinks workers are

unlikely to walk that far, especially in the winter. He is asking where the workers will park? Aside from where the staff is going to park and how that is going to work.

Mr. Ide is also concerned about the scale of the building. Every time they look at the plans there is a lot of pushing the limits on how tight things are stretched. When he looks at that emergency road it looks maybe wide enough for a smart car, but not three vehicles that always come with an emergency call in Arlington are going to get down that road if they need to and turn around. He is also concerned about the truck access and doesn't think it is big enough. He believes the building's size is being hidden, so he is concerned about the massiveness of the building.

Chairman Klein: Mr. Klein I would like to ask Mr. Hession to explain how the road that wraps around the backside of the property, how that is made up?

John Hession: Mr. Hession says that the emergency access path is 6' wide, porous asphalt that is reinforced earth material that provides a proper width for emergency vehicle access.

George Michael Hakim (10 Edith Street): Mr. Hakim shares the concerns of a fire truck turning into that emergency road with perhaps cars parked on the sides of the road. He thinks a senior facility will be beneficial in terms of traffic. He wants us not to lose sight of the massive amounts of garbage that has accumulated on this site for years, he would like to see that cleaned up before construction begins.

Chairman Klein: The Chairman noted that it is has been mentioned a couple of times the question about crowding in the school. The discussion of crowding in the schools is an implication that families would be unwelcome, and families are a protected group under federal law, so we really encourage people to not discuss school crowding as something that should be considered in this decision.

Mark McCabe: Mr. McCabe wanted to know what the independent living and assisted living apartments were going to look like, such as, studio, one bedroom, two bedrooms?

Arthur Klipfel: Mr. Klipfel explained that the assisted living will have a predominance of studios, which are a little less than 500 square feet, that is

an industry standard. There will be some one-bedrooms in the assisted living as well and for independent living where there is a predominance of one-bedrooms with a small number of two-bedrooms that would be the mix. There would be no micro-units and there would be no three-bedrooms.

Mark McCabe: Mr. McCabe asks, do you mean there will no three bedrooms at all within this development?

Chairman Klein: Mr. Chairman jumps in and states he believes that the duplex units are all three-bedroom units. Is that correct?

Stephanie Kiefer: Mr. Kiefer confirms that there are three-bedroom units.

Mark McCabe: Mr. McCabe goes on to clarify, do you mean the senior living and independent living building will have no three-bedrooms?

Chairman Klein: Mr. Chairman confirms that is correct.

Mark McCabe: Mr. McCabe also has a question regarding snow removal from the whole area. He would like to know who is going to be responsible for it, and where the snow is going to go, so that it doesn't flood people's basements/cellars?

John Hession: Mr. Hession states that they haven't located the snow removal, but the area would be graded so that the snow melt flows away from the abutting properties.

Mark McCabe: Mr. McCabe joins in on the discussion about vehicle use by the elderly and people working on the property. He would like to know why there are just assumptions and not numbers?

Scott Thornton: Mr. Thornton states they are still working on the traffic and some of the assumptions with the traffic analysis. They are not saying that everyone is going to take the T that works there, but he thinks it is likely that some people are going to use public transportation to get to the site. They are still working on an updated traffic impact assessment. More research is required.

Mark McCabe: Mr. McCabe with much frustration doesn't understand why they can go ahead with these diagrams when there are so many questionable things that have not been looked at yet.

Gwen Noyes: Mr. Noyes says she doesn't mean to give the impression that we were counting on the employees to use the Red Line, she was just saying that with the proximity to the Red Line it would make it available for staff. But, in fact, the numbers they have used for the parking spaces were derived from the data and tables from the ITE manual. They're real projections based on assisted living and independent living. They used the maximum number of parking spaces in the garage from the tables that were given which included the employees' and the resident numbers. That is one piece of data that has been generated from the professional records, it is not an assumption.

Mark McCabe: Mr. McCabe wanted to know what professional organization are these projections coming from?

Scott Thornton: Mr. Thornton responded: The Institute of Transportation Engineers Parking Generation Manual, Fifth Edition for assisted living and for senior housing. It's an industry-accepted source for parking estimates.

Mark McCabe: Mr. McCabe goes on to state that he is a little upset with Ms. Kiefer that if she believes that the ZBA does not allow this situation to go on, that she's going to jump right back onto the 176-unit apartment building and shove it down our throats. And he thinks that is a very unprofessional way to do business and thinks she might want to word it differently in the future.

Stephanie Kiefer: In response to Mr. McCabe, Ms. Kiefer responded by explaining that the Board, as she understood it, had asked the Applicant at the last hearing, to explore the reintroducing the townhouses. And so, they have done that on a conceptional level. She knows there has been a lot of thought that has been put into it, but obviously they haven't been able to answer every question. She went on to explain that it takes a lot of time and expense to further engineer and develop plans, so it is a fair request of an Applicant to ask the Board for their input as to whether they are going in the right direction or if they should go back to what they had before.

Ms. Kiefer went on to say that possibly Mr. McCabe misconstrued what she had been asking. The Applicant wanted the Boards' feedback on whether they are going in the right direction and should proceed or not.

Chairman Klein: The Chairman stated that the way he had understood it was that the Applicant was asking the Board if this was the way to proceed, and if not, they would be proceeding with the prior plan and in trying to finalize that.

Anita Gyron (47 Birch Street): Ms. Gyron stated that most of the discussion about the frontage had been in regards to Dorothy Road. She wanted to know about the views that the abutters from the eastern side would have.

Gwen Noyes: Ms. Noyes responded that the Applicant has been thinking a lot about the conservation area that is close to or more than 12 acres of land and they would like to have a conversation with the town about how best to approach this, and they understand there is work that needs to be done about cleaning up. There is a real concern about the invasive species and clean up. They have had conversations about timing that needs to be worked out. The property will be unrecognizable in its beauty when it is complete.

Chairman Klein: The Chairman asked whether there has been any thought about the cladding for the assisted living and independent building

Arthur Klipfel: Mr. Klipfel responded that assisted living buildings would be clad with panels and clapboard with trim. The duplexes would be the same materials, panels with vertical battens. They'd be clapboard, and panels even without the vertical battens.

Anita Gyron: Ms. Gyron asked, basically a residential type finish that wouldn't look too institutional or industrial?

Arthur Klipfel: Mr. Klipfel again responded, that was correct. They would spend more time analyzing the neighborhood and the different materials used in the neighborhood. The whole point is to have those six duplexes blend in with the neighborhood.

They will also take a look at the height as that had been mentioned. They have thought about modular construction, and there is actually three extra

feet in height because of the modular construction. So that is something they could look in possibly building those buildings a different way. But they thought modular would be good because it is much faster.

Anita Gyron: Ms. Gyron asked, did you say both the duplexes and the main building would be all modular units?

Arthur Klipfel: Mr. Klipfel explained that is their intention, but it's one of those details that has to be worked out.

Diego Gianolio (85 Dorothy Road): Mr. Gianolio agrees that a lot of time and effort has gone into this. However, one thing he feels should be clear at this point, is the potential for flooding. Mr. Gianolio goes on to state that in the whole presentation one thing that is not clear is the basements. The basements for the duplexes seem to be there, but it's not clear if they're going to be put in place or not. And if they are how deep they're going to be? The floor of his garage is actually less than four feet below street level, and it has experienced various flooding. He has had to have the sump pumps running all the time. He believes by now the Applicant they should have a good understanding of the water flow, how much water is expected, and what is the drainage system, etcetera?

The other question Mr. Gianolio had was about the modulares. He is concerned about the trucks and the overhead wires and whether or not they would have to cut the power. And if so, how are they going to provide power to the neighborhood during that time?

Scott Thornton: Mr. Thornton states that they haven't gotten into the type of construction and if the modular construction is still contemplated. If it is the trucks can go into the site and unload the materials and then go out Little John Street. The utility lines have to be 16 feet above the roadway at a minimum by code. The vehicles should not be any taller than 13.5 feet so the power lines shouldn't be an issue. He also adds that they've have an arborist selectively pruning tree limbs to ensure the clearance for the trucks.

Chairman Klein: Mr. Chairman had a question for Mr. Hession. He wanted to know if during their investigations they've looked at the surface flow and how water is moving specially from off-site areas into the site?

John Hession: Mr. Hession said that they do look into whether there is any water contributing to this projects' site, and they look at any water if there's any grades on this project site that actually drain out into Dorothy Road or onto any abutting properties. They have to accept water that follows onto site from off-site, but they have a responsibility to not increase flows from their site onto others.

Chairman Klein: The Chairman wanted to know if the Applicant was using the most recent iteration of the rainfall calculations, the NOAA 14 plus data which is what the town is starting to use, but it is in excess of what the current regulations are is that correct?

John Hession: Mr. Hession says they have been using the Cornell rainfall data which is required under the towns' wetlands regulations. As part of BETA's peer review or he believes the Board asked BETA to look at the drainage system if they used the NOAA 14 plus, and the drainage system worked with the exception of the hundred-year storm.

Diego Gianolio: Mr. Gianolio had a follow-up question about the basements. He asked if there are going to be basements or not because those, he assumes, will form a dam that will not allow water to go where it is apparently is going.

Gwen Noyes: In response to Mr. Gianolio's question, Ms. Noyes says that basements underneath the house would not allow at least surface water to go by. If Mr. Gianolio was referring to the ground water, there is 22 feet between the houses that would provide a passage for ground water to move. As stated, before they were thinking they might have partial basements and the stairs to the basement would not be lower than 11 feet or possibly 12 feet in height so they wouldn't naturally flood. She also understands that many of the driveways on the street are subject to flooding because the water flows right down into them. They have listened to these problems at every hearing, and have been working to address the water issue.

Martha Ingols (148 Herbert Road): Ms. Ingols, after looking at Google maps, suggests that if they gave up the sixth duplex at the corner of Little John that would allow more room for emergency vehicles. She also believes the outdoor socializing space is too close to Route 2 with a lot of pollution and noise. She

made a suggestion, as a possible solution, of putting a roof-top garden on top of the assisted living facility to provide more outdoor socializing space for the residents, and it would also absorb more rain water.

Gwen Noyes: Ms. Noyes responded to Ms. Ingols that she believes the distance to Route 2 is considerable. There's a tract of state-owned land between Route 2 and their property that can also be a buffer.

Lisa Fredman (63 Mott Street): Ms. Fredman says she is worried about the environmental impact, flooding and traffic. She believes that any major building will increase flooding on all streets. She prefers the townhomes without the senior living facility. She has had a lot of experience with seniors and says assisted living per person requires about one visit a day. Independent living can get up to 24 hours a day of help and with families coming multiple times a week it will end up affecting traffic and parking. Ms. Fredman would encourage the Board to go back to where they were at the last ZBA meeting thinking about a compromise that truly benefits people in the neighborhood. She believes that compromise is just restricting the development to the townhouses.

Chairman Klein: Mr. Chairman states that seeing no other hands raised, they can now go back to Ms. Chapnick's question about the AURA.

John Hession: Mr. Hession explains that some of the confusion may have been from the number of drawings. In the C105 drawing, which is the grading and drainage plan they had adjusted grading where they had pointed out that they had a couple of minor issues, and they adjusted some of the drainage structures and the connections to the building. Mr. Hession pointed out on that drawing there's a dashed line that is outside of the footprint of the residential portion of the building. It extends outside of the residential footprint to the north towards Dorothy and then in the rear, the courtyard area, where they were discussing the work in the AURA on the southwest side of the building. Mr. Hession states that the footprint of the building and the garage had not changed at all since that November 3rd full submission of both the full site plans, and that's where he believes that got confused.

Patrick Hanlon: Mr. Hanlon does believe there was a miscommunication that took place, but it is also clear what the facts are, there is an intrusion of

the building into the AURA. He does believe the conditions haven't changed, but feels that there are some things that the Conservation Commission may not have considered. The Conservation Commission will have additional comments after the new revision.

John Hession: Mr. Hession responds to Mr. Hanlon. He does want to say it was presented most likely at the Conservation Commission, but also as part of the ZBA when they presented those revised plans, the November 3rd plans, that it was pointed out that there was a small 270 something square foot intrusion of the building into the very outer 13 feet at the greatest of the building into that AURA. Mr. Hession just wanted to put it on record it is not new information, it was presented in the past and it hasn't changed.

Patrick Hanlon: Mr. Hanlon in response to Mr. Hession states that what he is trying to get across is that from where they are right now it doesn't really matter. He believes Ms. Chapnick when she says the Conservation Commission, if they heard this, did not focus on this, and did not assume it. And the Board needs the advice from them as to what to do now even though it hasn't changed.

Chairman Klein: The Chairman asks if there are any further questions from the public; hearing none he states that the public comment period for this hearing is closed.

Chairman Klein: The Chairman now goes on to state there are a couple of things that are before the Board at the moment.

- Plans: One is the request of the Applicant to get a little bit better direction as to whether or not they should proceed along the lines discussed here or whether they should revert back to what they were pursuing before. Or whether we want them to continue alone this path, but keeping an eye on certain things moving forward.

The Chairman feels this is a much better plan in terms of keeping with a lot of the discussion had earlier. The Chairman admits he is still trying to digest exactly what it means to have a large assisted and independent living

building in this portion of the neighborhood. But it sounds like there are definitively some advantages to pursuing this rather than open apartments.

- AURA: The Board and Chair of the Conservation Commission have made it clear that the AURA issue should be looked at. Is there a straightforward way of addressing that that preserves the AURA? Or is it something that the Applicant feels they cannot get away from, and that they are really limited to having to maintain that insertion?
- Basements: There have also been questions raised about the basements in the duplex units. The water issues not only are an issue for the new tenants, but could also cause additional issues with current residents in the neighborhood. If basements are included in the project, they are included in a way that they are not a risk for the people owning them.
- Elevations: There has also been some concern about the elevation of the garage level in the larger building. Mr. Chairman thinks higher is better, it is now above what we understand the water table to be.
- Water Flow: Mr. Chairman stated he's not sure if it's due to a lack of drains in the street or what the condition is but it has been described by multiple people that water flows through the neighborhood and then off the edge of the roadway on Dorothy into the woods. And that is the natural flow pattern right now. He feels the Board would need to understand if that really is the water flow pattern, and then they need to figure out what is going on and see if that would need an intervention as part of whatever is being proposed.

Chairman Klein: The Chairman asked if there were any other concerns that the Board has or recalled being raised that need to be added?

Patrick Hanlon: Mr. Hanlon noted:

- Traffic: That there were some concerns raised about what the actual traffic picture would be with the change in use.

- **Storm Water Management:** Mr. Hession had pointed out that the storm water management is easier now that it's not as cramped a site as it was before. But there still needs to be some research done on the storm water management, because it is so important.
- **Unit Heights:** And Mr. Hanlon had had some question regarding the heights of the townhouse units. In the course of the discussion there were a number of things individually, not very large, but certainly were things to be thinking about and seeing whether there's some finetuning needed.

Stephen Revilak: Mr. Revilak stated he had a few items. He lives along the Alewife Brook in a 100-year flood plain. Yes, his house does occasionally flood its not ground water that comes up through the basement its overland that forms a big pond in the land behind his house. Living in that situation I have really leaned toward buildings in flood plains that are elevated on piles. That might be a more practical solution approach and just forgo the basement altogether.

During the public comment period he did not hear anyone say, let's stick with the 172-unit apartment, so he concurs that this is an improvement and would like to continue down this path.

Chair Klein: On behalf of the Board, Mr. Chairman, says that the Board views this new plan quite favorability, and would like to see some further refinements on it especially in light of some of the comments this evening. He would ask Ms. Kiefer whether this gives her the direction she was hoping to receive.

Stephanie Kiefer: Ms. Kiefer stated she thinks that it does, and appreciates the feedback on this.

Chairman Klein: Mr. Chairman states they will need to continue the hearing. The first issue would be is that the 180-day calendar is set to expire next Thursday. I believe we would be looking to extend that out in order to further refine this.

Patrick Hanlon: Mr. Hanlon has one other thing he is concerned with and that is what is to be done with the conservation land. It really has not been addressed. It has not really changed since last time, but they are nearing the end and he hopes that the town will engage with the Applicant between now and the next time, and

that they can have some useful discussions that would develop that issue for us. One way or the other this is part of the application, and the Board is going to have to address it.

The Chairman asks for a motion to extend the 180-day review period for Thorndike Place to Friday June 25, 2021.

SO MOVED by Mr. Hanlon

Seconded by Mr. Revilak

Roll call vote **SO VOTED** **5-0**

The Chairman asks for a motion to continue the hearing for Thorndike Place until Thursday June 10th, 2021 at 7:30 p.m.

SO MOVED by Mr. Hanlon

Seconded by Mr. Revilak

Roll call vote **SO VOTED** **5-0**

Chairman Klein: If anyone has comments or recommendations, please send them via email to zba@town.arlington.ma.us that email address is also listed on the ZBA website.

Asks for a motion to adjourn.

SO MOVED by Mr. Hanlon

Seconded by Mr. Mills

SO VOTED **5-0**

MEETING IS ADJOURNED.



Town of Arlington, Massachusetts

Thorndike Place

ATTACHMENTS:

Type	File Name	Description
Reference Material	Ltr_ZBA_8_2_21_Thorndike_Place_(00201098xBC4F6).pdf	Ltr_ZBA 8_2_21_Thorndike Place (00201098xBC4F6)
Reference Material	Resubmission_Set_-_Thorndike_Place_(7.26.21)_(00201099xBC4F6).pdf	Resubmission Set - Thorndike Place (7.26.21) (00201099xBC4F6)
Reference Material	2021-08-02_GradingPlan-Rev7_(00201153xBC4F6).pdf	2021-08-02 GradingPlan-Rev7 (00201153xBC4F6)
Reference Material	2021-08-02_LayoutPlan-Rev7_(00201151xBC4F6).pdf	2021-08-02 LayoutPlan-Rev7 (00201151xBC4F6)
Reference Material	2021-08-02_Turning_Exhibits_(00201154xBC4F6).pdf	2021-08-02 Turning Exhibits (00201154xBC4F6)
Reference Material	2021-08-02_UtilityPlan-Rev7_(00201152xBC4F6).pdf	2021-08-02 UtilityPlan-Rev7 (00201152xBC4F6)
Reference Material	2021-08-03_Thorndike_Place_Response_to_Comments_(00201155xBC4F6).pdf	2021-08-03 Thorndike Place Response to Comments (00201155xBC4F6)
Reference Material	8451_J._Raitt_080321_Traffic_Peer_Review_response_(00201148xBC4F6).pdf	8451 J. Raitt 080321_Traffic Peer Review response (00201148xBC4F6)
Reference Material	8451_ZBA_080321_Revised_Traffic_Analysis_(00201160xBC4F6).pdf	8451 ZBA 080321 Revised Traffic Analysis (00201160xBC4F6)
Reference Material	Project_Overview8.3.21_(00201161xBC4F6).pdf	Project Overview8.3.21 (00201161xBC4F6)
Reference Material	Waiver_List_6-29_update_(00198686-2xBC4F6).pdf	Waiver List_6-29 update (00198686- 2xBC4F6)

August 2, 2021

Via Email

Rick Vallarelli
Arlington Zoning Board of Appeals
51 Grove Street
Arlington, MA 02476

Attn: Christian Klein, Chair

**RE: ZBA Docket #3515 /Thorndike Place, Arlington, MA
Supplemental Architectural Materials**

Dear Mr. Vallarelli,

On behalf of the Applicant, enclosed please find an updated set of architectural plan materials prepared by GreenStaxx/Bruce Ronanye Hamilton Architects, as revised through July 26, 2021.

The enclosed materials consists of eighteen (18) sheets, including:

- (1) Sketch plan of revised project layout – this sketch has previously been submitted to the ZBA, and is used solely for an overview of the project. Technical updates to the architectural or civil plans that are being presented to the ZBA at the August 3, 2021 hearing;
- (2) 3D Perspective Along Dorothy Road – Looking West
- (3) Parking Garage Plan (Independent Living Building)
- (4) Ground Floor Plan (Independent Living Building);
- (5) Second Floor Plan (Independent Living Building);
- (6) Third Floor Plan (Independent Living Building);
- (7) Fourth Floor Plan (Independent Living Building);
- (8) Duplex “A” Floor Plans;
- (9) Duplex “B” Floor Plans;
- (10) Duplex “A” Elevations;
- (11) Duplex “B” Elevations;
- (12) North Elevation – Dorothy Road;
- (13) West Elevation – Dorothy Road;
- (14) North Elevation – 4 Story Building;
- (15) East Elevation;
- (16) South Elevation;
- (17) Site Section at West End – Dorothy Road; and
- (18) Site Section at East End – Dorothy Road.

SMOLAK & VAUGHAN LLP

Arlington Zoning Board of Appeals
August 2, 2021

The updated information from the BSC Group and VAI will be provided under a separate cover. We look forward to discussing these matters with the Board tomorrow evening.

Sincerely,

/s/ Stephanie A. Kiefer

Stephanie A. Kiefer

Encl.

cc:

Paul Haverty, Esq.

Jenny Raitt, Director of Planning and Community Development





3D PERSPECTIVE ALONG DOROTHY ROAD - LOOKING WEST

SCALE -

THORNDIKE PLACE

ARLINGTON, MA.
JULY 26, 2021

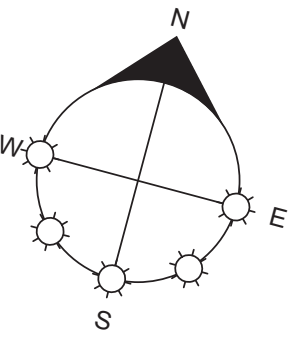
ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

green
STAXX



BRUCE
RONAYNE
HAMILTON
ARCHITECTS

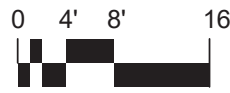


UNIT MATRIX

	ONE BEDROOMS (AVG. SF: 636 ft ²)	TWO BEDROOMS (AVG. SF: 1,048 ft ²)	STUDIOS (AVG. SF: 505 ft ²)	TOTAL UNITS PER FLOOR
GROUND FLOOR	9	5	13	27
SECOND FLOOR	12	5	10	27
THIRD FLOOR	19	7	10	36
FOURTH FLOOR	18	6	10	34
TOTAL	58	23	43	TOTAL: 124 UNITS

THIS TABLE EXCLUDES ALL COMMON AREAS & AMMENITIES

GROUND FLOOR PLAN



KEY

- COMMON AREAS
- SITE ACCESS AREAS
- STUDIO UNITS
- 1 BEDROOM UNITS
- 2 BEDROOM UNITS

THORNDIKE PLACE

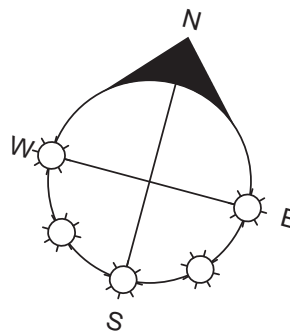
ARLINGTON, MA.
JULY 22, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

green
STAXX

BRUCE
RONAYNE
HAMILTON
ARCHITECTS



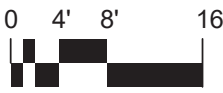
RENTABLE AREA: 21,461 SF
COMMON AREA/AMENITIES: 11,247 SF

UNIT MATRIX

	ONE BEDROOMS (AVG. SF: 636 ft ²)	TWO BEDROOMS (AVG. SF: 1,048 ft ²)	STUDIOS (AVG. SF: 505 ft ²)	TOTAL UNITS PER FLOOR
GROUND FLOOR	9	5	13	27
SECOND FLOOR	12	5	10	27
THIRD FLOOR	19	7	10	36
FOURTH FLOOR	18	6	10	34
TOTAL	58	23	43	TOTAL: 124 UNITS

THIS TABLE EXCLUDES ALL COMMON AREAS & AMMENITIES

SECOND FLOOR PLAN



KEY

COMMON AREAS

SITE ACCESS AREAS

STUDIO UNITS

1 BEDROOM UNITS

2 BEDROOM UNITS

THORNDIKE PLACE

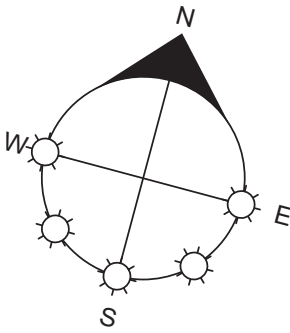
ARLINGTON, MA.
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

green
STAXX

BRUCE
RONAYNE
HAMILTON
ARCHITECTS



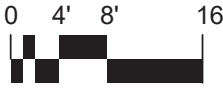
RENTABLE AREA: 29,929 SF
COMMON AREA: 2,779 SF

UNIT MATRIX

	ONE BEDROOMS (AVG. SF: 636 ft ²)	TWO BEDROOMS (AVG. SF: 1,048 ft ²)	STUDIOS (AVG. SF: 505 ft ²)	TOTAL UNITS PER FLOOR
GROUND FLOOR	9	5	13	27
SECOND FLOOR	12	5	10	27
THIRD FLOOR	19	7	10	36
FOURTH FLOOR	18	6	10	34
TOTAL	58	23	43	TOTAL: 124 UNITS

THIS TABLE EXCLUDES ALL COMMON AREAS & AMMENITIES

THIRD FLOOR PLAN



KEY

- COMMON AREAS
- SITE ACCESS AREAS
- STUDIO UNITS
- 1 BEDROOM UNITS
- 2 BEDROOM UNITS

THORNDIKE PLACE

ARLINGTON, MA.
JULY 26, 2021

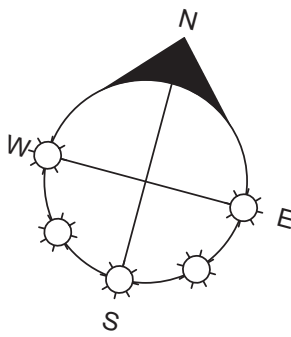
ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

green
STAXX



BRUCE
RONAYNE
HAMILTON
ARCHITECTS



RENTABLE AREA: 27,900 SF
COMMON AREA/AMENITIES: 4,808 SF

UNIT MATRIX

	ONE BEDROOMS (AVG. SF: 636 ft ²)	TWO BEDROOMS (AVG. SF: 1,048 ft ²)	STUDIOS (AVG. SF: 505 ft ²)	TOTAL UNITS PER FLOOR
GROUND FLOOR	9	5	13	27
SECOND FLOOR	12	5	10	27
THIRD FLOOR	14	7	10	36
FOURTH FLOOR	18	6	10	34
TOTAL	58	23	43	TOTAL: 124 UNITS

THIS TABLE EXCLUDES ALL COMMON AREAS & AMMENITIES

FOURTH FLOOR PLAN

SCALE - As Indicated

KEY

COMMON AREAS

SITE ACCESS AREAS

STUDIO UNITS

1 BEDROOM UNITS

2 BEDROOM UNITS

THORNDIKE PLACE

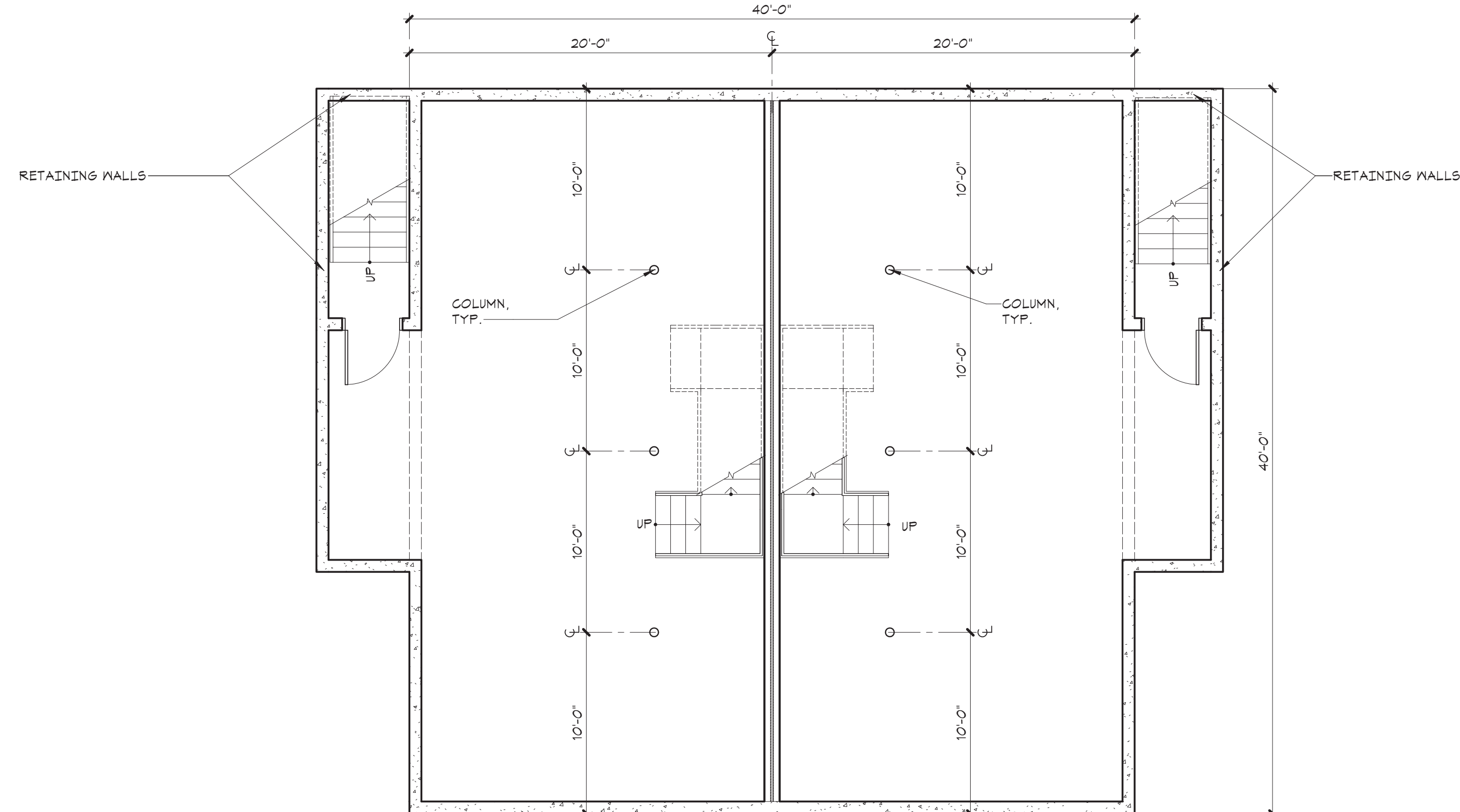
ARLINGTON, MA.
JULY 26, 2021

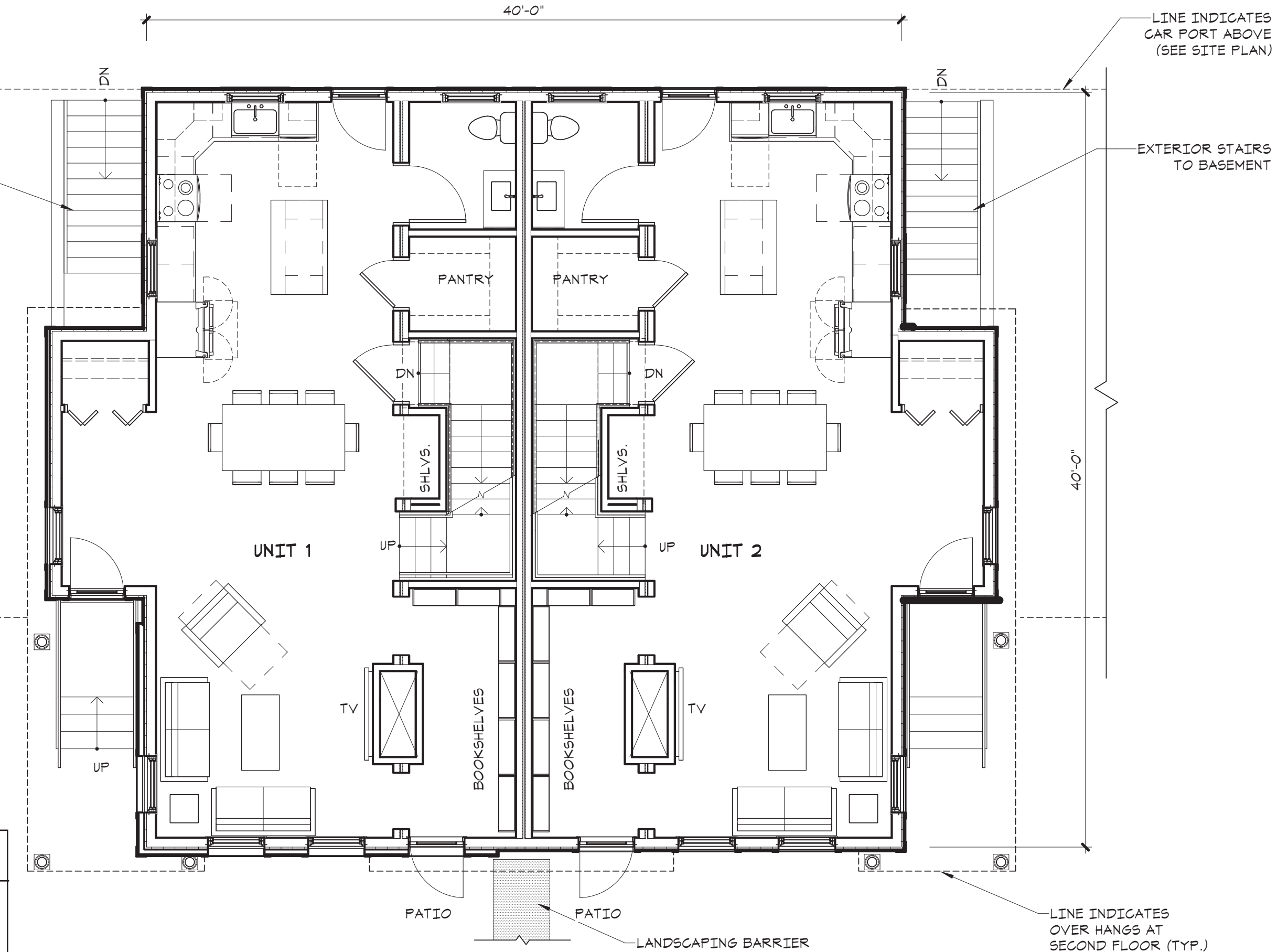
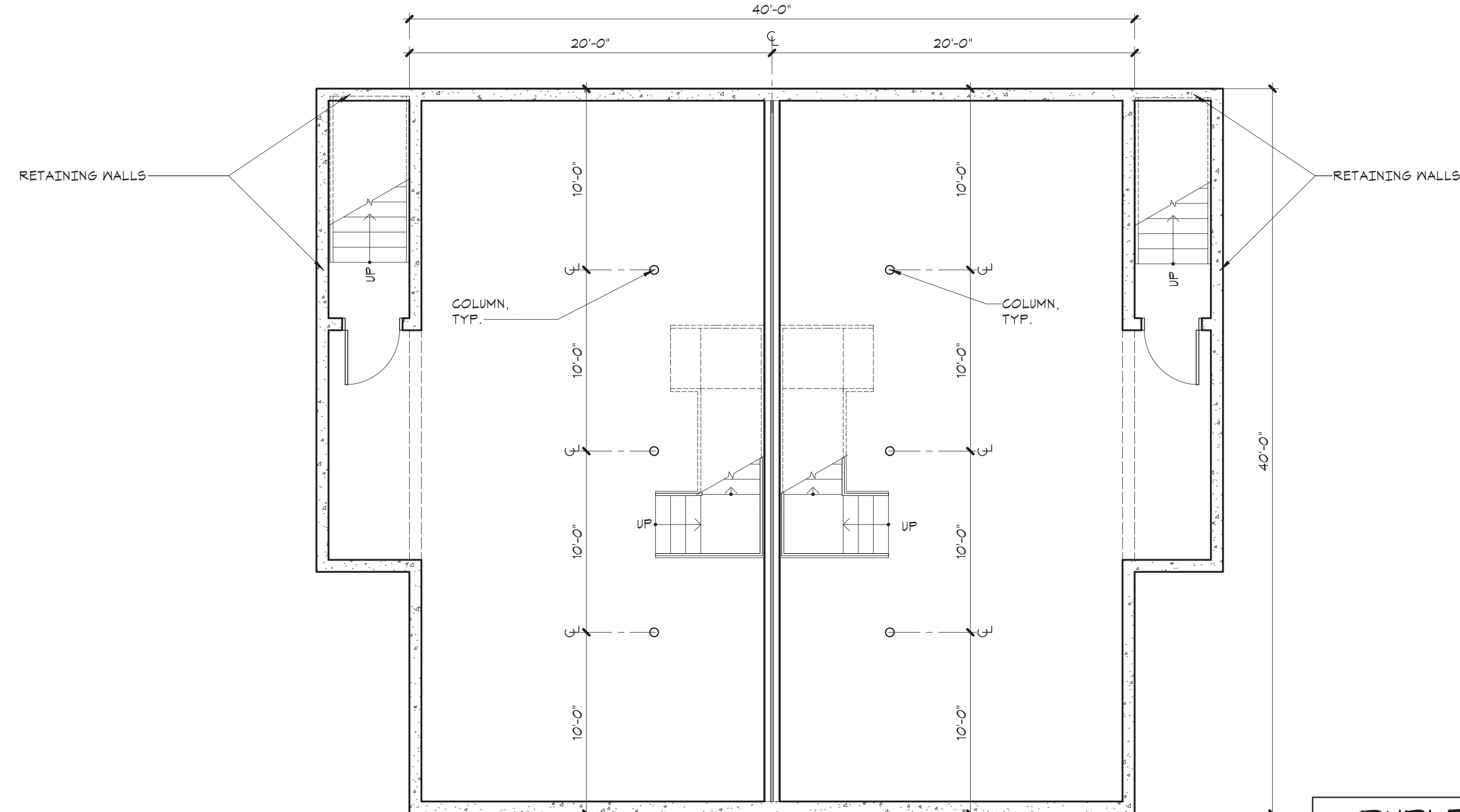
ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

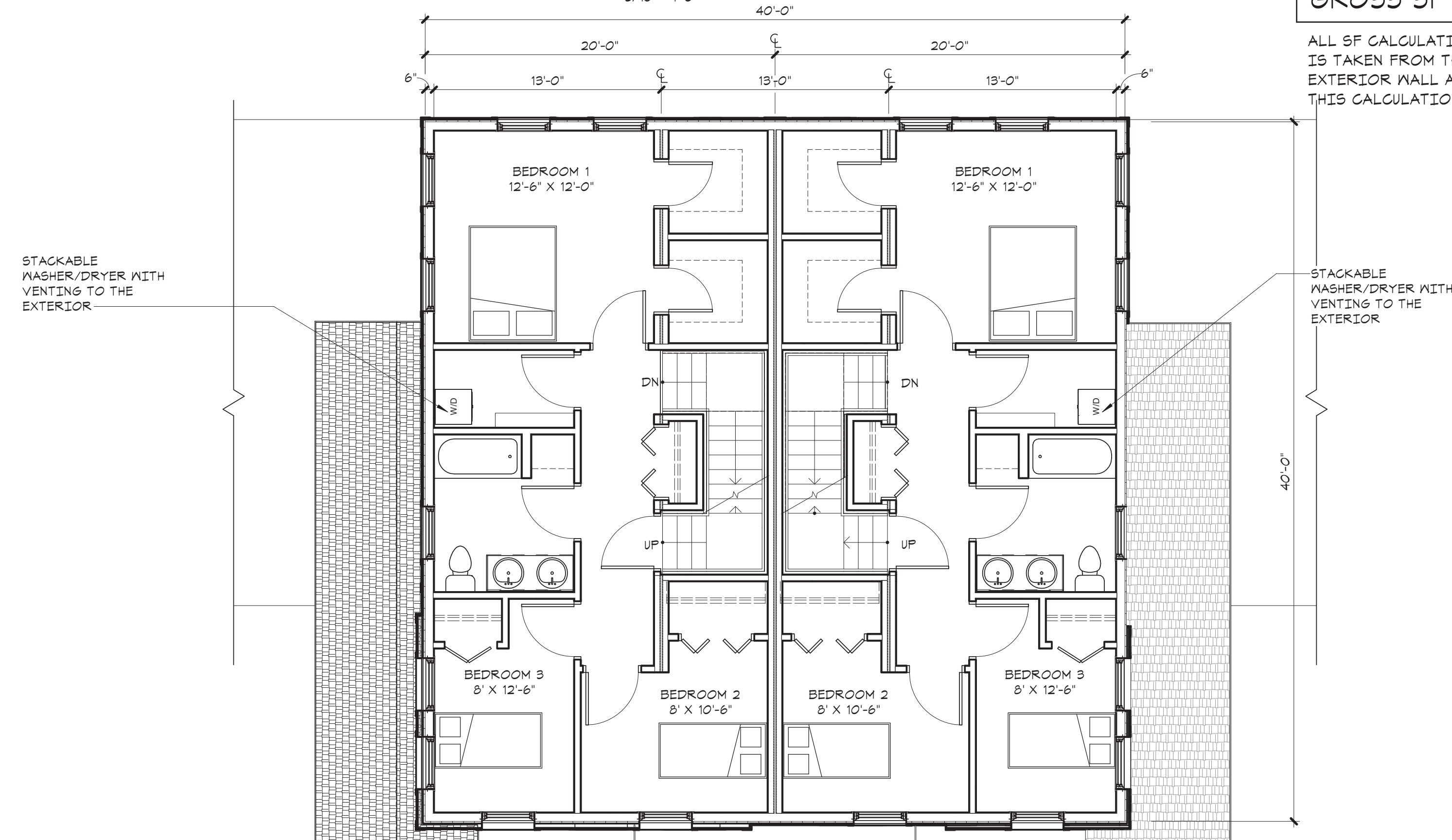
green
STAXX

BRUCE
RONAYNE
HAMILTON
ARCHITECTS





BASEMENT FLOOR PLAN



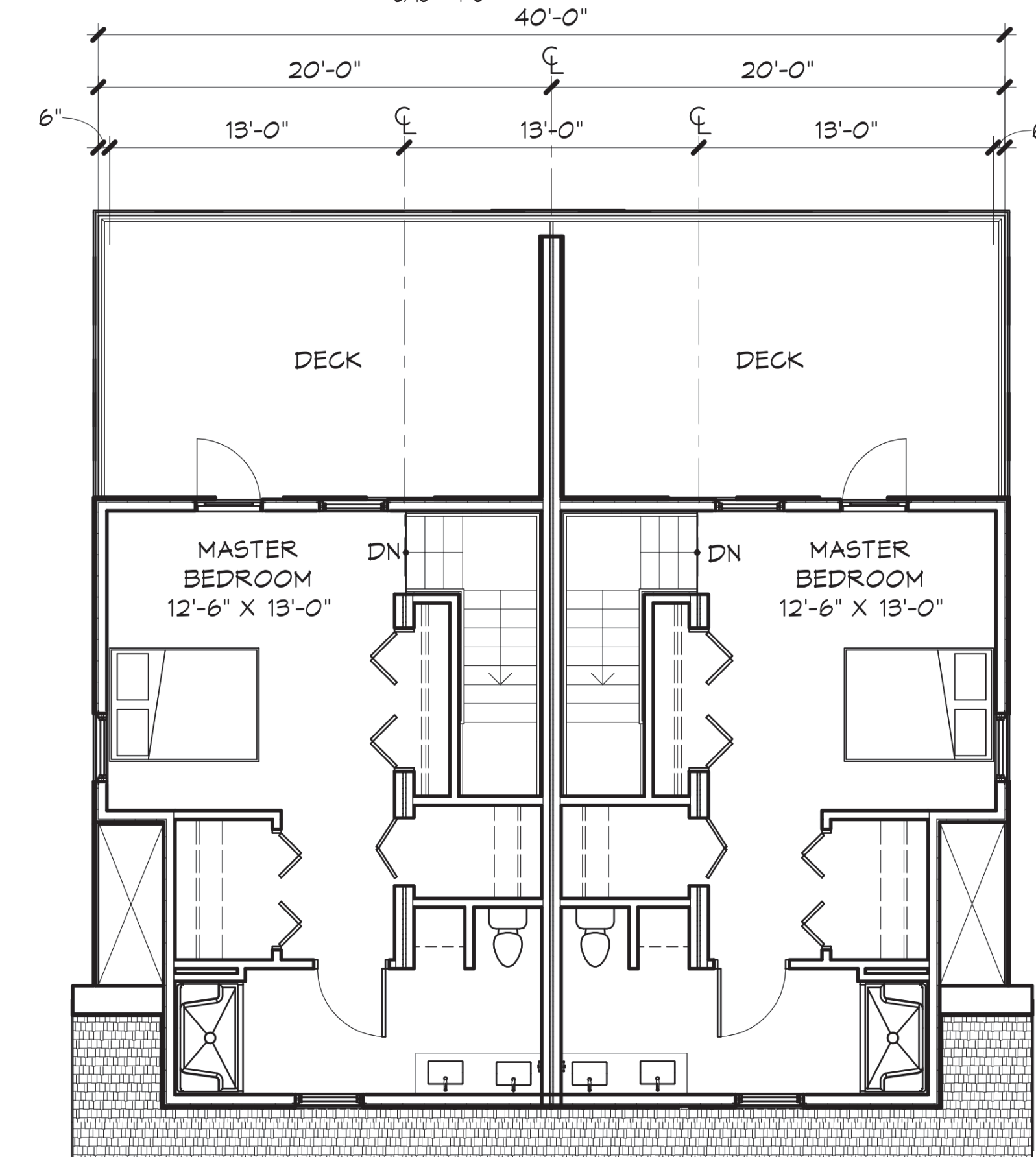
SECOND FLOOR PLAN

DUPLEX SF PER UNIT

FIRST FLOOR: 806 SF
SECOND FLOOR: 743 SF
THIRD FLOOR: 457 SF
GROSS SF PER UNIT: 2,006 SF

ALL SF CALCULATIONS ARE OF LIVING SF WHICH
IS TAKEN FROM THE INTERIOR FACE OF
EXTERIOR WALL AND INCLUDES INTERIOR WALLS
THIS CALCULATION EXCLUDES THE BASEMENT

FIRST FLOOR PLAN



THIRD FLOOR PLAN

THORNDIKE PLACE - DUPLEXES

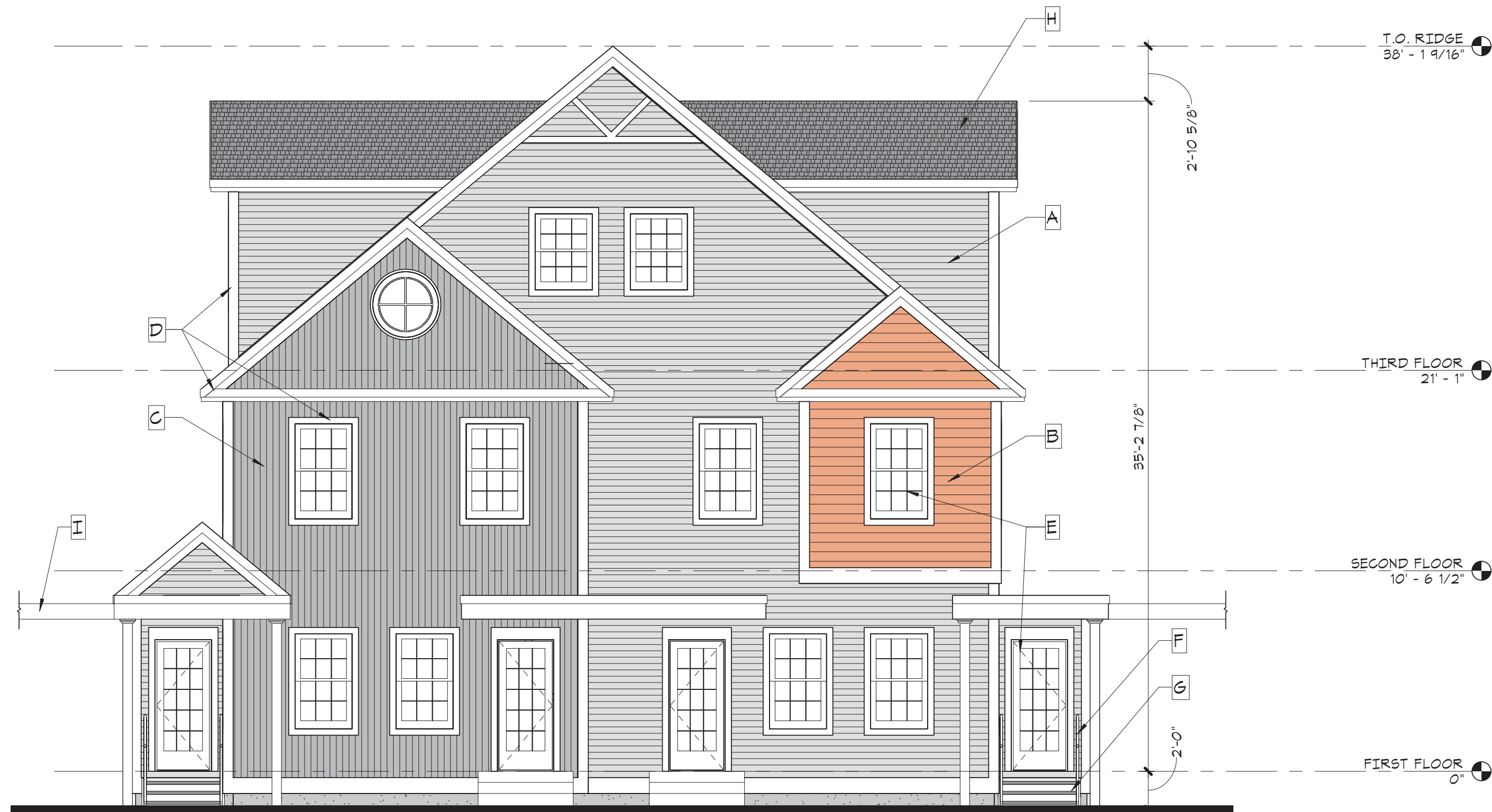
ARLINGTON, MA.

JULY 26, 2021

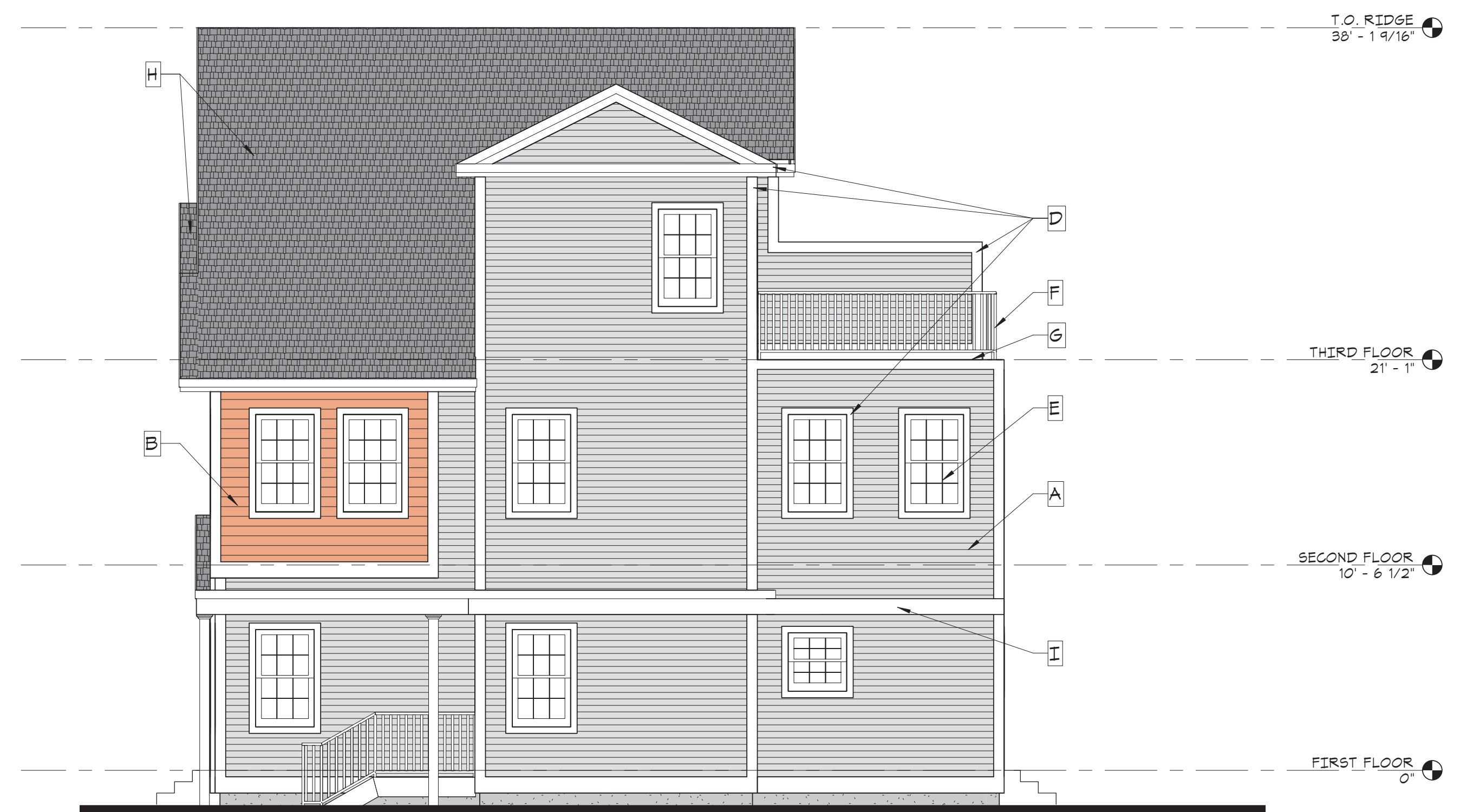
ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

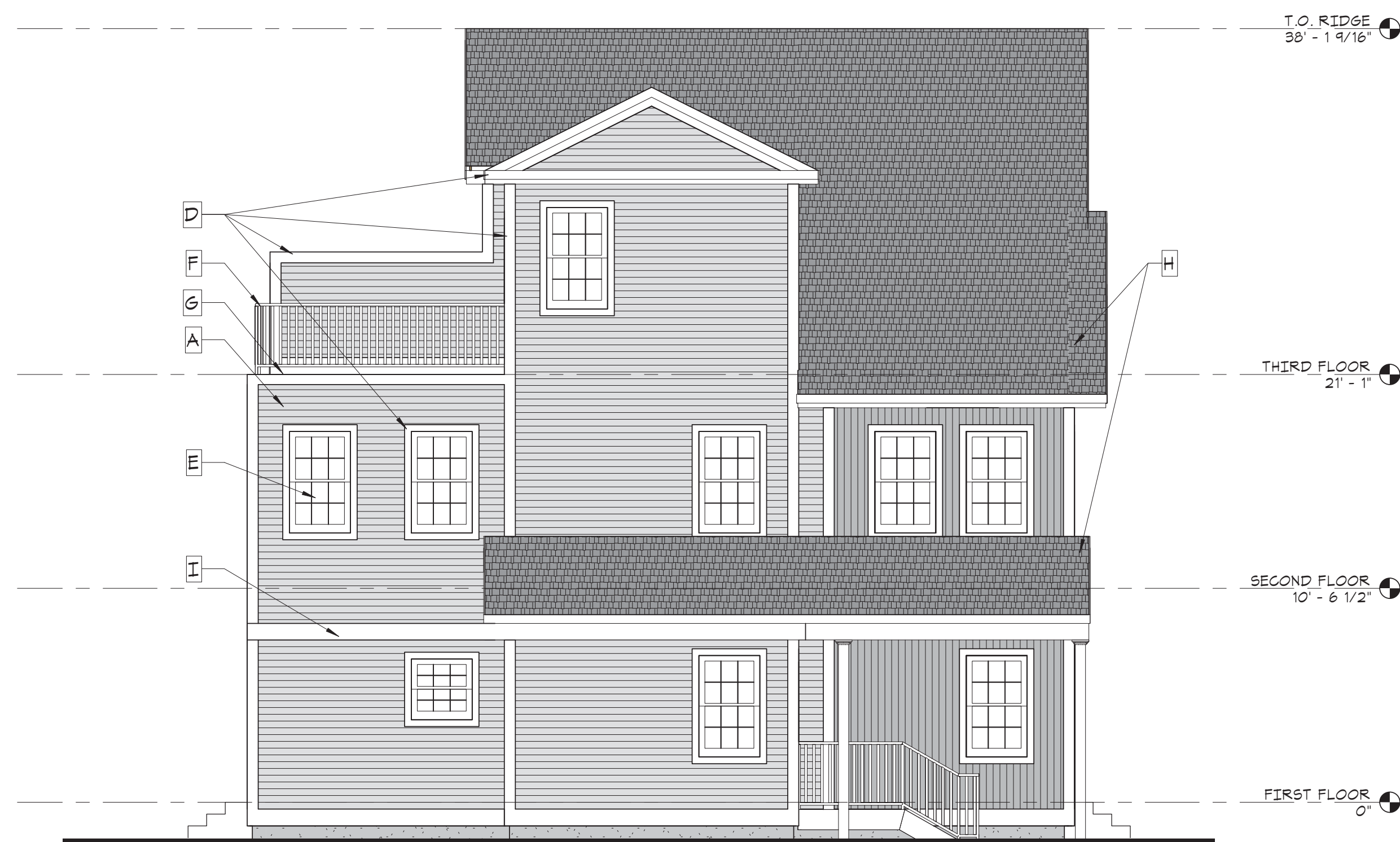




FRONT ELEVATION
3/16" = 1'-0"



TYPICAL RIGHT SIDE ELEVATION
3/16" = 1'-0"



TYPICAL LEFT SIDE ELEVATION
3/16" = 1'-0"



REAR ELEVATION
3/16" = 1'-0"

MATERIAL LEGEND

A CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT	E INSULATED VINYL WINDOWS AND DOORS
B CEMENTITIOUS HORIZONTAL ACCENT SIDING, COLOR BY ARCHITECT	F VINYL RAILINGS, COLOR BY ARCHITECT
C CEMENTITIOUS VERTICAL ACCENT SIDING, COLOR BY ARCHITECT	G TREX DECKING FOR EXTERIOR STAIRS AND DECKS, COLOR BY ARCHITECT
D COMPOSITE TRIMS, COLOR BY ARCHITECT	H ARCHITECTURAL ASPHALT SHINGLES
	I CARPORT, REFER TO CIVIL PLANS

52 of 355

DUPLEX 'A' - ELEVATIONS



THORNDIKE PLACE - DUPLEXES

ARLINGTON, MA.
JULY 26, 2021

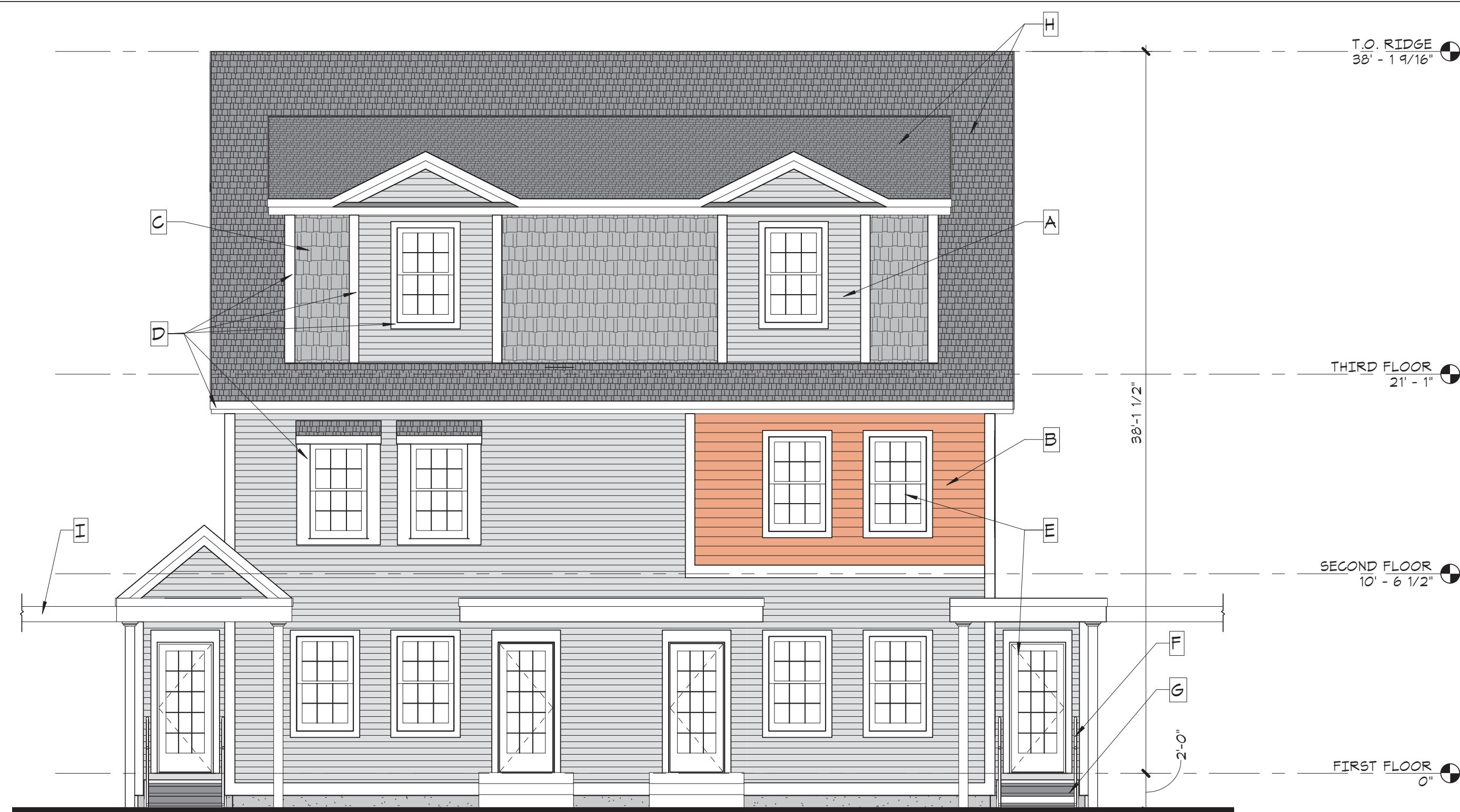
ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

green
STAXX



BRUCE
RONAYNE
HAMILTON
ARCHITECTS



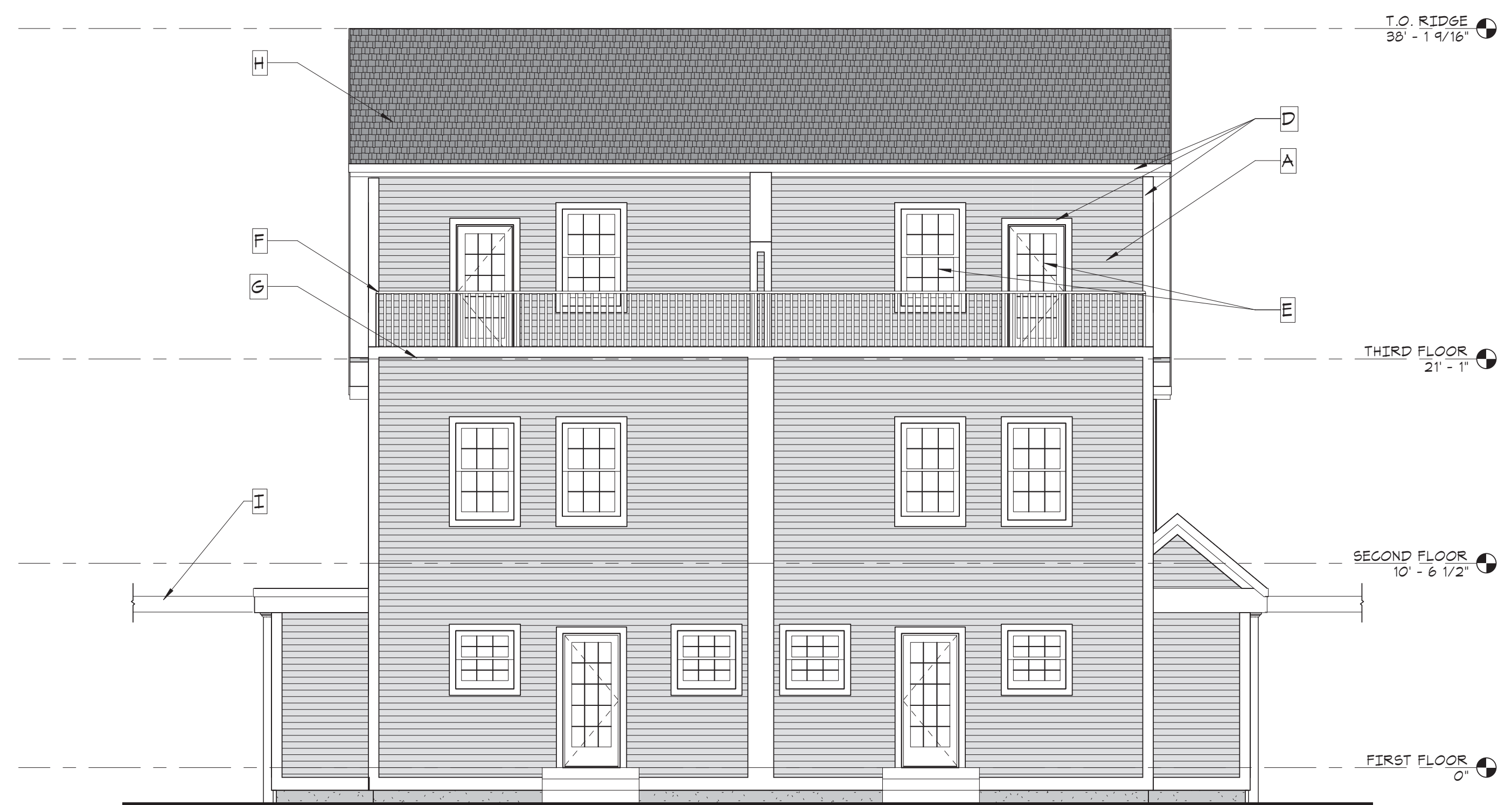
FRONT ELEVATION
3/16" = 1'-0"



TYPICAL RIGHT SIDE ELEVATION
3/16" = 1'-0"



TYPICAL LEFT SIDE ELEVATION
3/16" = 1'-0"



REAR ELEVATION
3/16" = 1'-0"

MATERIAL LEGEND

- | | |
|--|---|
| A CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT | E INSULATED VINYL WINDOWS AND DOORS |
| B CEMENTITIOUS HORIZONTAL ACCENT SIDING, COLOR BY ARCHITECT | F VINYL RAILINGS, COLOR BY ARCHITECT |
| C CEMENTITIOUS SHAKE ACCENT SIDING, COLOR BY ARCHITECT | G TREX DECKING FOR EXTERIOR STAIRS AND DECKS, COLOR BY ARCHITECT |
| D COMPOSITE TRIMS, COLOR BY ARCHITECT | H ARCHITECTURAL ASPHALT SHINGLES |
| | I CARPORT, REFER TO CIVIL PLANS |

53 of 355

DUPLEX 'B' - ELEVATIONS



THORNDIKE PLACE - DUPLEXES

ARLINGTON, MA.
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

green
STAXX



BRUCE
RONAYNE
HAMILTON
ARCHITECTS



NORTH ELEVATION
1/16" = 1'-0"



ENLARGED NORTH ELEVATION
1/8" = 1'-0"

NORTH ELEVATION - DOROTHY ROAD

SCALE - As Indicated

THORNDIKE PLACE

ARLINGTON, MA.
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

green
STAXX



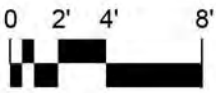
BRUCE
RONAYNE
HAMILTON
ARCHITECTS



MATERIAL LEGEND

- | | | | |
|----|--|---|---|
| A | CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT | F | CONCRETE FOUNDATION WALL W/ PARGE COATING STUCCO FINISH, COLOR BY ARCHITECT |
| B1 | CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT | G | VERTICAL BATTEN SIDING |
| B2 | CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT | H | AWNING WITH CABLE ROD SUPPORTS |
| B3 | PANEL JOINT | J | ENTRANCE DOORS |
| C | COMPOSITE TRIMS, COLOR BY ARCHITECT | K | OVERHEAD DOOR |
| D | INSULATED WINDOW & DOOR UNIT WITH OPERABLE PANELS AS INDICATED | L | EGRESS DOORS, SEE GROUND FLOOR PLAN |
| E | JULIET BALCONY | M | GARAGE ENTRY CANOPY WITH STRUCTURAL COLUMNS |
| | | N | RETAINING WALLS (SEE CIVIL) |

WEST ELEVATION



THORNDIKE PLACE

ARLINGTON, MA.
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071





NORTH ELEVATION OF
FOUR-STORY BUILDING

1/16" = 1'-0"



ENLARGED NORTH
ELEVATION OF
FOUR-STORY BUILDING

1" = 10'-0"

MATERIAL LEGEND

A	CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT	F	CONCRETE FOUNDATION WALL W/ FARGE COATING STUCCO FINISH, COLOR BY ARCHITECT
B1	CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT	G	VERTICAL BATTEN SIDING
B2	CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT	H	AWNING WITH CABLE ROD SUPPORTS
B3	PANEL JOINT	J	ENTRANCE DOORS
C	COMPOSITE TRIMS, COLOR BY ARCHITECT	K	OVERHEAD DOOR
D	INSULATED WINDOW & DOOR UNIT WITH OPERABLE PANELS AS INDICATED	L	EGRESS DOORS, SEE GROUND FLOOR PLAN
E	JULIET BALCONY	M	GARAGE ENTRY CANOPY WITH STRUCTURAL COLUMNS
		N	RETAINING WALLS (SEE CIVIL)

NORTH ELEVATION - 4-STORY
BUILDING

SCALE - As Indicated

THORNDIKE PLACE

ARLINGTON, MA.
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

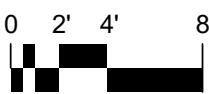




MATERIAL LEGEND

A	CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT	F	CONCRETE FOUNDATION WALL W/ PARGE COATING STUCCO FINISH, COLOR BY ARCHITECT
B1	CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT	G	VERTICAL BATTEN SIDING
B2	CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT	H	AWNING WITH CABLE ROD SUPPORTS
B3	PANEL JOINT	J	ENTRANCE DOORS
C	COMPOSITE TRIMS, COLOR BY ARCHITECT	K	OVERHEAD DOOR
D	INSULATED WINDOW & DOOR UNIT WITH OPERABLE PANELS AS INDICATED	L	EGRESS DOORS, SEE GROUND FLOOR PLAN
E	JULIET BALCONY	M	GARAGE ENTRY CANOPY WITH STRUCTURAL COLUMNS
		N	RETAINING WALLS (SEE CIVIL)

EAST ELEVATION



THORNDIKE PLACE

ARLINGTON, MA.
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071

green
STAXX



BRUCE
RONAYNE
HAMILTON
ARCHITECTS



SOUTH ELEVATION
1/16" = 1'-0"



ENLARGED SOUTH ELEVATION
1" = 10'-0"

MATERIAL LEGEND

A CEMENTITIOUS HORIZONTAL SIDING, COLOR BY ARCHITECT	F CONCRETE FOUNDATION WALL W/ PARGE COATING STUCCO FINISH, COLOR BY ARCHITECT
B1 CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT	G VERTICAL BATTEN SIDING
B2 CEMENTITIOUS PANEL ACCENT SIDING, COLOR BY ARCHITECT	H AWNING WITH CABLE ROD SUPPORTS
B3 PANEL JOINT	J ENTRANCE DOORS
C COMPOSITE TRIMS, COLOR BY ARCHITECT	K OVERHEAD DOOR
D INSULATED WINDOW & DOOR UNIT WITH OPERABLE PANELS AS INDICATED	L EGRESS DOORS, SEE GROUND FLOOR PLAN
E JULIET BALCONY	M GARAGE ENTRY CANOPY WITH STRUCTURAL COLUMNS
	N RETAINING WALLS (SEE CIVIL)

SOUTH ELEVATION

SCALE - As Indicated

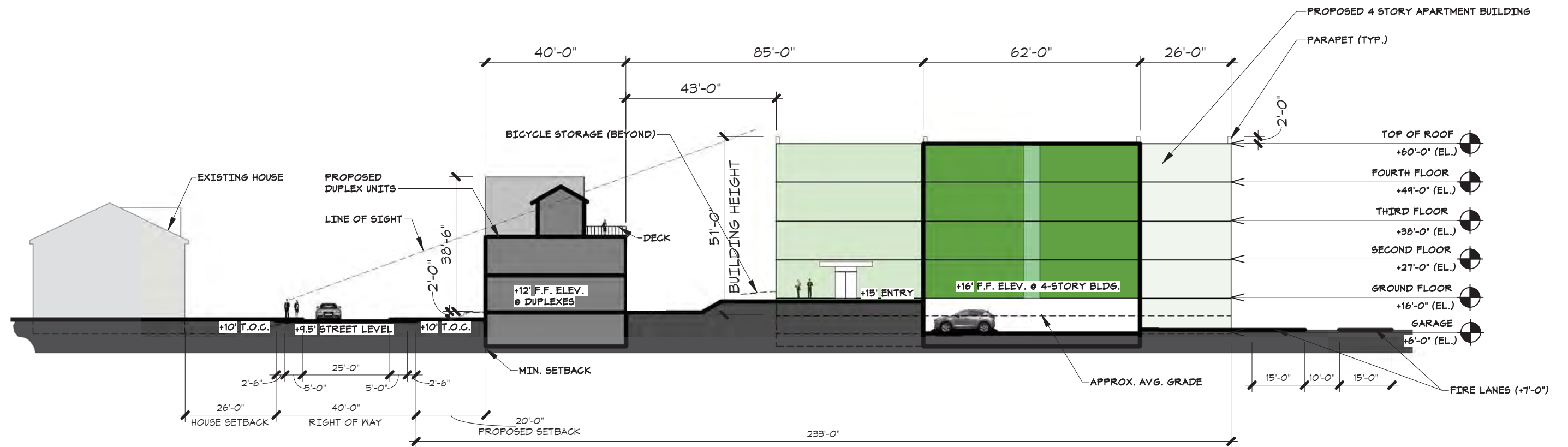
THORNDIKE PLACE

ARLINGTON, MA.
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071





SITE SECTION AT WEST END - DOROTHY ROAD

SCALE - 1" = 30'-0"

THORNDIKE PLACE

ARLINGTON, MA.

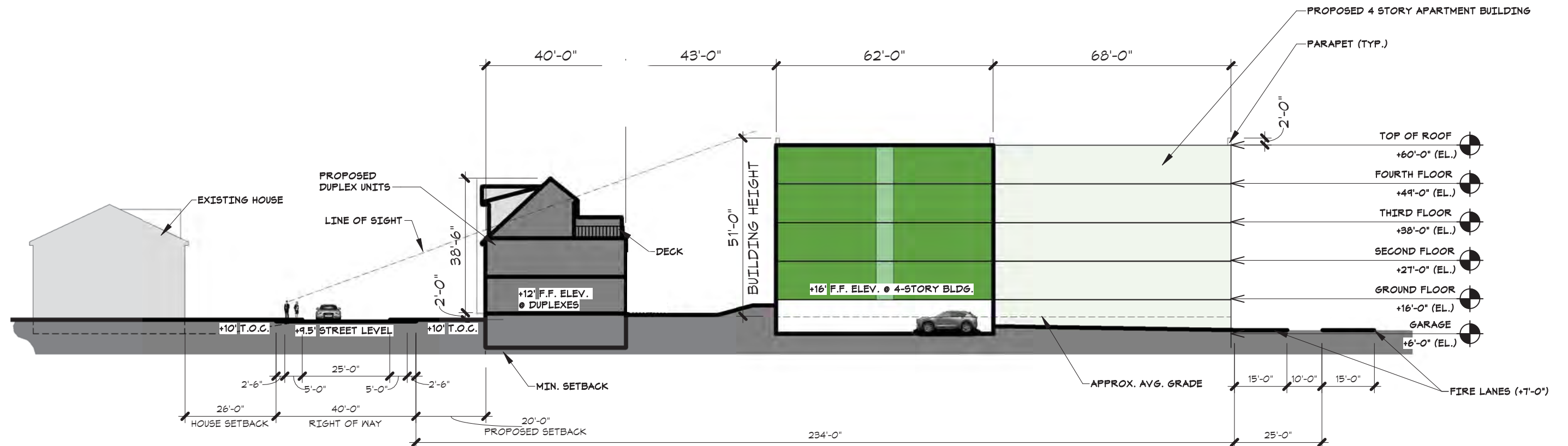
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071



BRUCE
RONAYNE
HAMILTON
ARCHITECTS



SITE SECTION AT EAST END - DOROTHY ROAD

SCALE - 1" = 30'-0"

THORNDIKE PLACE

ARLINGTON, MA.

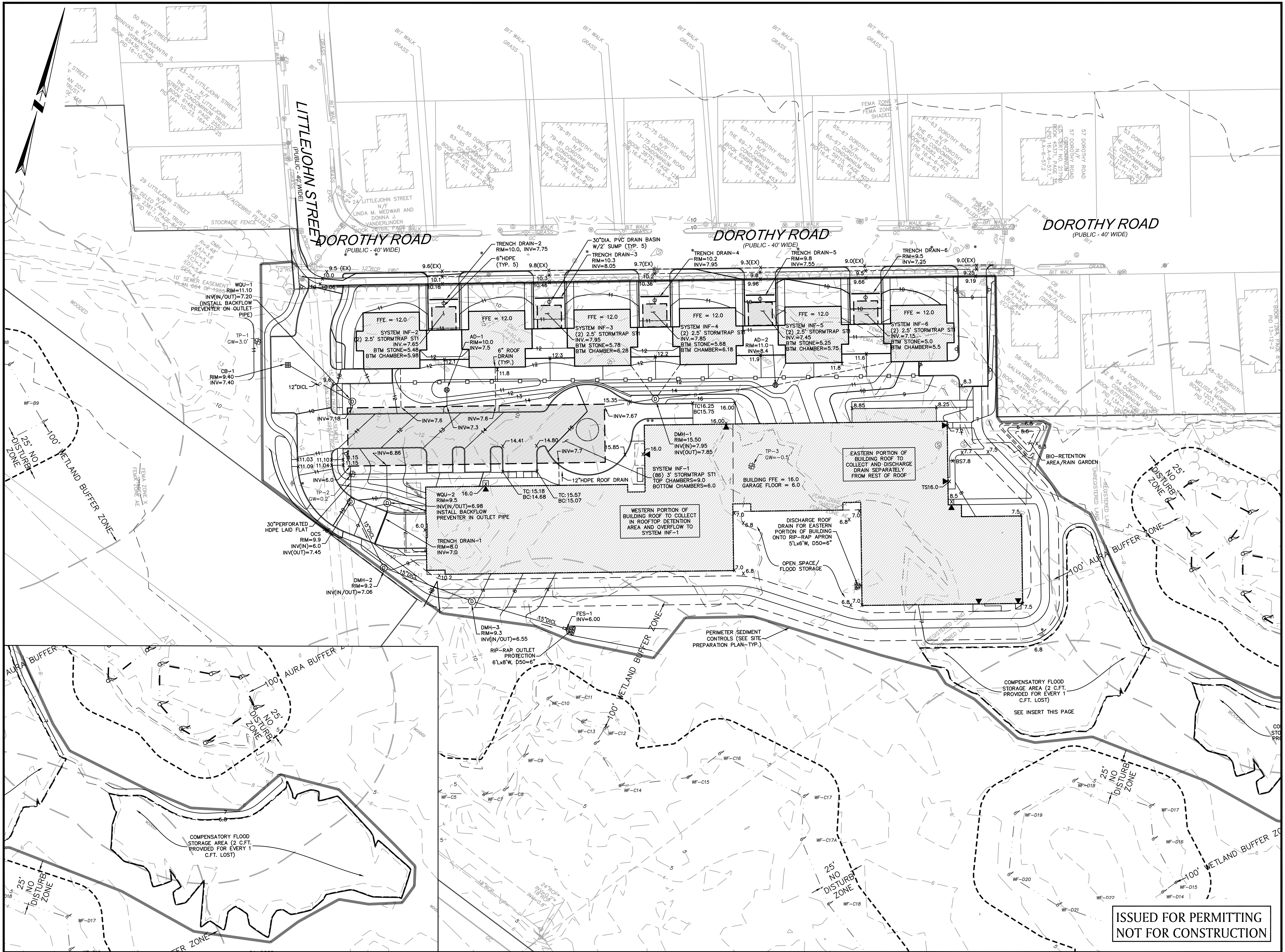
JULY 26, 2021

ARCHITECTURE
LAND PLANNING
INTERIOR DESIGN
3D VISUALIZATION

833 TURNPIKE ROAD P.O. BOX 104
NEW IPSWICH NEW HAMPSHIRE 03071



BRUCE
RONAYNE
HAMILTON
ARCHITECTS



PROFESSIONAL ENGINEER

THORNDIKE PLACE

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

**GRADING &
DRAINAGE PLAN**

MARCH 13, 2020

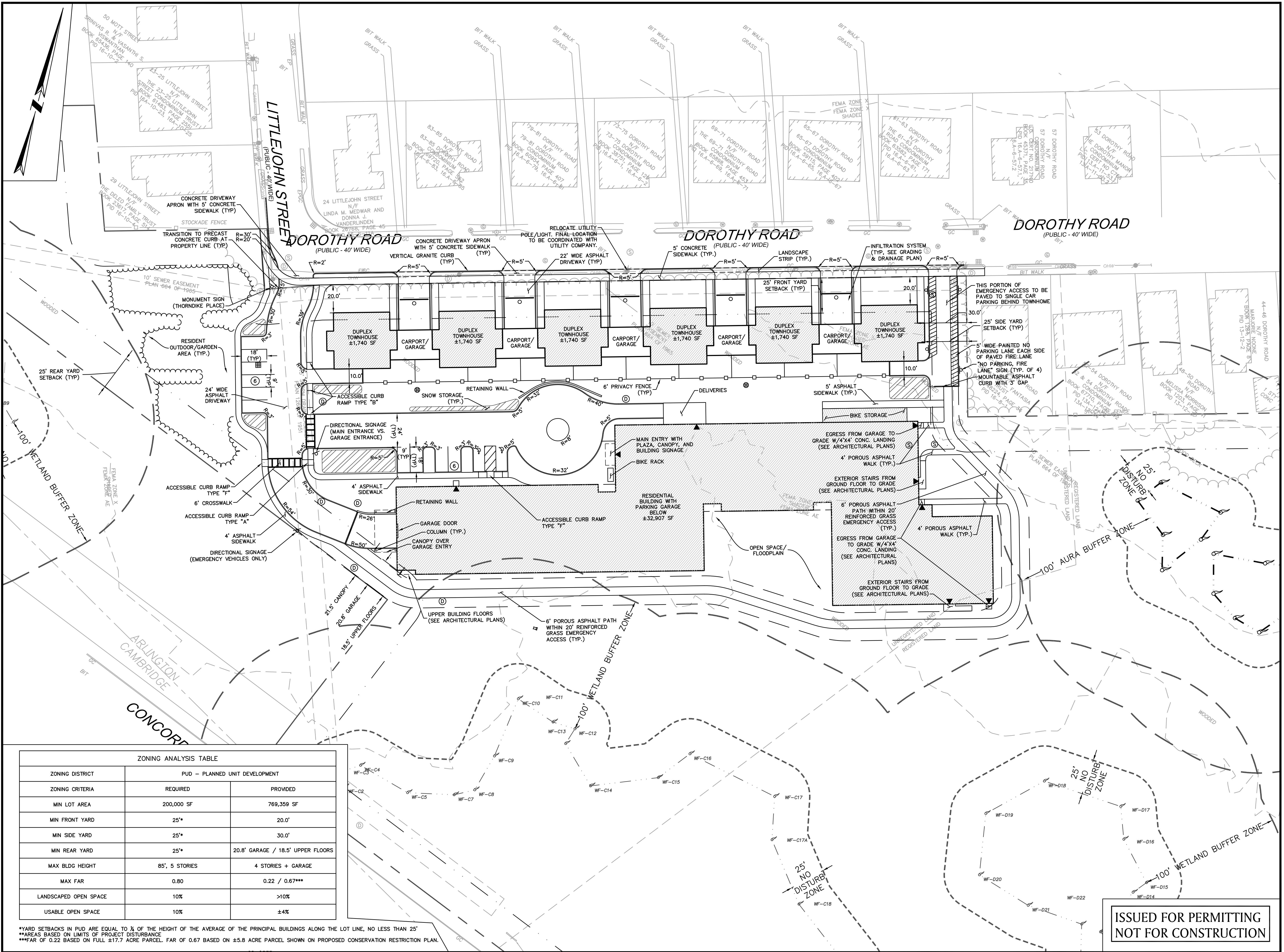
REVISIONS:		
NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING
4	3/11/21	LAYOUT REVISIONS
5	5/10/21	NEW BUILDING FOOTPRINT
6	6/3/21	NEW BUILDING GRADING
7	8/2/21	REVS PER TOWN COMMENT

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

© 2020 BSC Group, Inc.
SCALE: 1" = 30'
0 15 30 60 FEET
FILE: \Civil_Drawings\2340700-GR
DWG.:
JOB. NO: 23407.00 SHEET C-105

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION



PROFESSIONAL ENGINEER

THORNDIKE PLACE

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

LAYOUT & MATERIALS
PLAN

MARCH 13, 2020

REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING
4	3/11/21	LAYOUT REVISIONS
5	5/10/21	NEW BUILDING FOOTPRINT
6	6/3/21	NEW BUILDING GRADING
7	8/2/21	REVS PER TOWN COMMENT

PREPARED FOR:

ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

803 Summer Street
Boston, Massachusetts
02127

617 896 4300

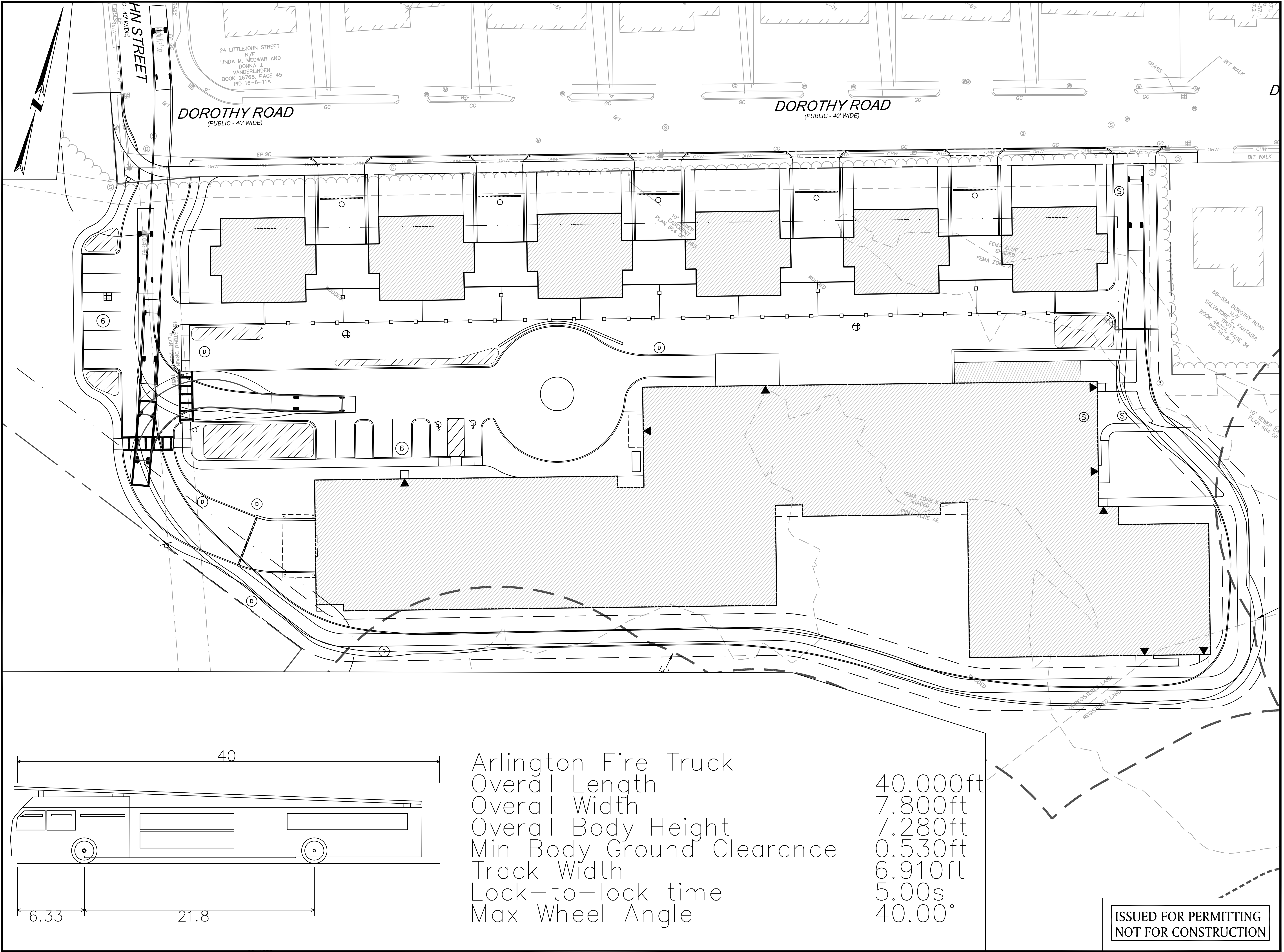
© 2020 BSC Group, Inc.

SCALE: 1" = 30'

0 15 30 60 FEET

FILE: \Civil\Drawings\2340700-LM
DWG.:
JOB. NO: 23407.00 SHEET C-103

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION



PROFESSIONAL ENGINEER

THORNDIKE PLACE

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

ARLINGTON FIRE TRUCK
TURNING EXHIBIT

JANUARY 12, 2021

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING
4	3/11/21	LAYOUT REVISIONS
5	5/10/21	NEW BUILDING FOOTPRINT
6	6/3/21	NEW BUILDING GRADING
7	8/2/21	REVS PER TOWN COMMENT

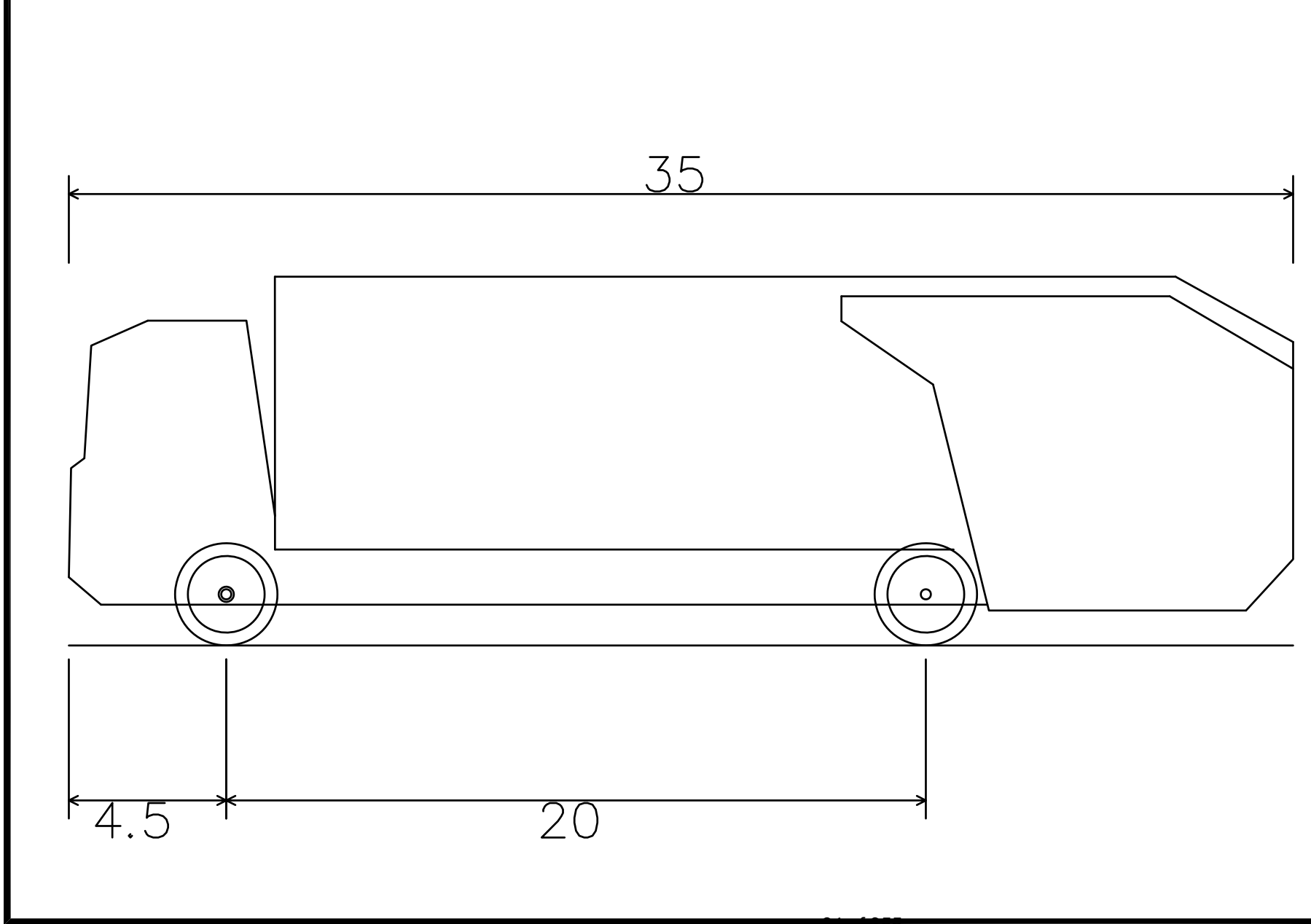
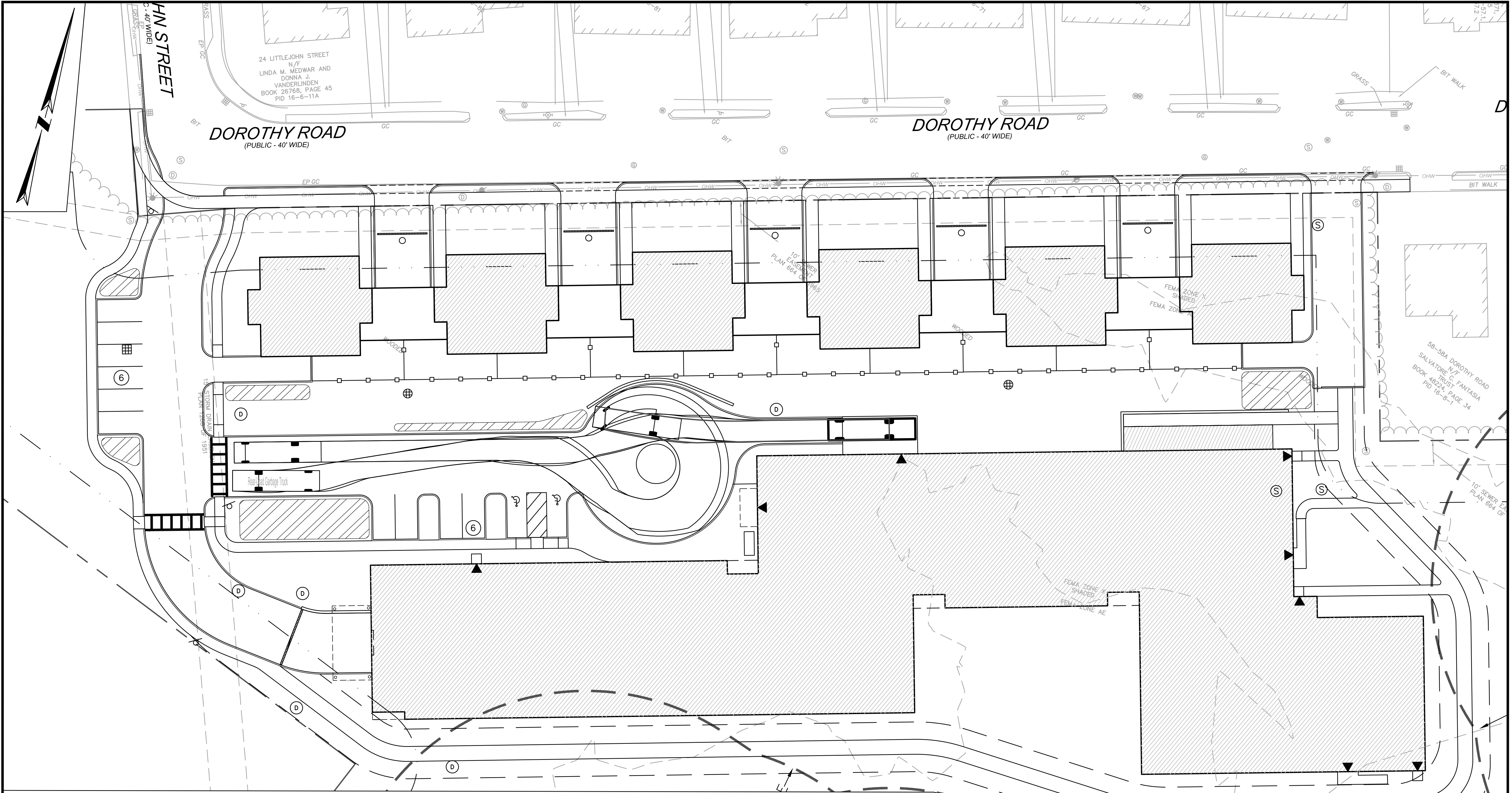
PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

803 Summer Street
Boston, Massachusetts
02127
617 896 4300

© 2020 BSC Group, Inc.
SCALE: 1" = 20'
0 10 20 40 FEET

FILE: \Civil_Drawings\2340700-LM
DWG.: ATRN-FIRE
JOB. NO: 23407.00

SHEET SK-01



Rear-Load Garbage Truck
Overall Length 35.000ft
Overall Width 8.375ft
Overall Body Height 10.546ft
Min Body Ground Clearance 1.000ft
Track Width 8.375ft
Lock-to-lock time 6.00s
Curb to Curb Turning Radius 29.300ft

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

GARBAGE TRUCK
TURNING EXHIBIT

JANUARY 12, 2021

REVISIONS:

NO.	DATE	DESC.
1	9/18/20	NEW BUILDING FOOTPRINT
2	10/22/20	WETLAND DELINEATION
3	11/03/20	REVISED BUILDING
4	3/11/21	LAYOUT REVISIONS
5	5/10/21	NEW BUILDING FOOTPRINT
6	6/3/21	NEW BUILDING GRADING
7	8/2/21	REVS PER TOWN COMMENT

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300



803 Summer Street
Boston, MA 02127

Tel: 617-896-4300

www.bscgroup.com

Sent Via Email

August 3, 2021

Jenny Raitt, Director
Department of Planning and Community Development
50 Pleasant Street
Arlington, Massachusetts 02476

RE: Response to BETA Civil / Wetland Peer Review
Dated June 25, 2021
Thorndike Place Comprehensive Permit Application

Dear Ms. Raitt:

On behalf of the Applicant, Arlington Land Realty LLC, BSC Group, Inc. (BSC) is pleased to provide the following responses to peer review for the Thorndike Place residential project on Dorothy Road in Arlington, Massachusetts.

This letter responds to comments provided by BETA Group, Inc. (BETA) in a letter to you dated June 25, 2021. Due to the significant revision to the site plan (senior living and duplex townhomes). BETA provided new comments 1 – 14 related to the June 8, 2021 submission materials. BETA also included previous comments and responses for reference, however, BETA did not include BSC's February 16, 2021 or March 10, 2021 responses. BSC's February 16, 2021 or March 10, 2021 responses are provided again for reference.

The section headings and comment numbers below correspond to the comments from BETA. For clarity, we have repeated original comments in standard text and provided our responses to the June 25, 2021 comments and the previously submitted February 16, 2021 and March 10, 2021 responses in italics.

PROPOSED PROJECT

The proposed project, as revised, includes the construction of a 124-unit 4-story senior living building and six (6) duplex townhouse buildings (12 units) located along Dorothy Road. Also included are associated access driveways, parking areas, utilities, infrastructure, and stormwater management system.

June 8, 2021 Revised Submission

1. The Applicant has submitted select plans including Layout and Materials Plan and Grading & Drainage Plan in support of the latest revisions.

Recommendation: A full set of plans should be submitted to the Board reflecting the proposed revisions.

BSC Response: Revised Layout & Materials, Grading & Drainage and Utility Plans (C-103, C-105 and C-106) are included with this response. In addition, a revised Potential Conservation Parcel and Vehicle Turning Exhibits are attached. A complete set of plans and stormwater report will be submitted by August 24, 2021.

2. Access to the front of the proposed senior living building is provided by an approximately 200-foot long driveway with a cul-de-sac turn around. The proposed building extends about 215 feet



beyond the end of the driveway. It is not clear how the fire department will access the entire front of the building for firefighting purposes.

Recommendation: The Applicant should confirm with the fire chief that the site as proposed will provide adequate access for firefighting. The chief's confirmation should be provided to the Board in writing.

BSC Response: Feedback was provided by the Fire Chief where he indicated that if the proposed project can accommodate the size of the ladder truck for emergency access and the project meets State Fire Code requirements, then at this juncture there is not any further review required. The Fire Department will review final plans and construction documents as part of the regular interdepartmental review that would occur once the project is in a permitting phase (building permit). BSC has confirmed that the Arlington Fire Department ladder truck can navigate the west, south and east sides of the site via the main driveway and emergency vehicle access drive. Additionally, the ladder truck can access the driveway to the senior living building and exit using the driveway as a hammerhead turnaround. Truck turning exhibits are attached to this letter. The site and building will meet the State Fire Code and provide a compliant route for emergency vehicles to access the building.

3. A portion of the perimeter emergency access road is shared with the proposed driveway access for Townhouse 6 (easterly building). Parking must be prohibited along this portion of the emergency access to ensure that it remains clear for emergency vehicles.

Recommendation: The Applicant should include appropriate signage and pavement markings to restrict parking.

BSC Response: Signage and pavement markings restricting parking on the emergency vehicle access drive adjacent to the easterly duplex will be provided.

4. It appears that there is an existing utility pole located in the proposed driveway for Townhouse units 3 & 4 that will require relocation.

Recommendation: The new pole location should be shown on the plans and coordinated with the utility company.

BSC Response: The existing utility pole conflict with the proposed driveway location is noted on the Layout & Materials Plan (C-103) and is noted that the relocation of the pole is to be coordinated with the utility company.

5. The proposed project as revised results in filling within the existing 100-year floodplain. Two areas of compensatory flood storage are proposed south of the senior living building. The areas as proposed appear to provide a compensation ration of 2:1 which meets the Town's requirements. Both areas appear to be partially within the 100-foot AURA but outside the 25-foot No Disturb Zone.

Recommendation: The Applicant should confirm that the Conservation Commission is satisfied with the compensatory storage areas as proposed.

BSC Response: The proposed compensatory flood storage areas provide the required 2:1 storage volume. Additionally, the proposed compensatory storage areas are in areas that have been previously disturbed by the prior homeless encampment and are overrun with invasive species. BETA has provided the following comments that support the proposed location of the compensatory storage areas with recommendations for revegetation:

"BETA's wildlife biologist reviewed the revised plans to evaluate the impacts of the newly proposed compensatory flood storage areas. These areas both located south/



southeast of the main building in a heavily wooded area on the site. Currently these regions are densely vegetated and upslope of isolated wetland WF-D series. This serves as a water filtration system to the downstream wetlands as well as preventing erosion by holding on to sediment and slowing stormwater. However, the vegetation is mostly invasive species and an abundance of dead trees. While the dense vegetation and standing deadwood provides good nesting habitat, this feature exists in other areas of the property.

Constructing these compensatory flood storage areas will most likely involve clearing any existing vegetation and re-grading the area creating the opportunity to replant and seed the area with native species to add productivity the remaining area. Dense shrubs such as high bush blueberry can provide dense cover and food sources for wildlife for example. Pollinator species should also be considered to replace what will be lost in the surrounding area during clearing. This will also be an important feature for retaining water and nutrients in these areas and prevent standing water which is a breeding ground for insects."

Stormwater Management

The Stormwater Management design for the site is similar to the previous design. Runoff will be collected in a series of catch basins and trench drains and directed to subsurface infiltration systems. A single large infiltration system is proposed for the senior living building and driveways. Separate small infiltration systems are proposed for the Townhouse driveways. A portion of the roof of the senior living building will be used to detain stormwater. A small raingarden is proposed at the easterly side of the site.

6. Each discharge to the large infiltration system (IFN-1) is treated by a water quality unit and/or deep sump catch basing to remove total suspended solids before the runoff is infiltrated. This is consistent with the guidance in the Massachusetts Stormwater Policy. However, the trench drain/infiltration systems for the townhouse units do not provide water quality treatment. These systems service a small area. However, accumulation of sediment over time will reduce the effectiveness of infiltration.

Recommendation: The Applicant should consider providing a sump between the driveway trench drains and infiltration systems to allow removal of some total sediment solids.

BSC Response: A 30" diameter drain manhole with a 2' sump and hood has been added between each trench drain and infiltration system and is shown on the Grading and Drainage Plan (C-105).

7. The location of floor drains and connection to the sanitary sewer system should be shown to ensure that they do not conflict with other subsurface utilities.

Recommendation: Show garage floor drain connections on the plans.

BSC Response: Location of the oil/water separator and sump pump is shown on the Utility Plan (C-106).

8. The top elevations for infiltration systems INF-5 and INF-6 appear to the finish grade of the driveways.

Recommendation: The Applicant should consider if these systems need to be lowered to accommodate the driveway construction.

BSC Response: Elevations of each system have been revised accordingly.



Stormwater Report

9. In general, the revised stormwater analysis appropriately models the new design. NOAA 14+ rainfall data has been used in the analysis. Overall post development peak runoff rates for the site are mitigated to be equal to or lower than predevelopment peak runoff rates.

BSC Response: No response required.

10. Stormwater Management Standards 1 -10 appear to be satisfied.

BSC Response: No response required.

11. As previously noted, the analysis indicates that post development runoff rates for the entire site are mitigated. However, the analysis also indicates that post development runoff rates towards Dorothy Road are higher than predevelopment runoff rates for the 100-year storm. Predevelopment Subcatchment 2S (flow to street) shows a runoff rate of 1.3 CFS. Post development Subcatchment 7S (flow to street) shows a runoff rate of 1.9 cfs.

Recommendation: Given the sensitivity of flooding issues on Dorothy Road, the post development runoff rate flowing towards Dorothy Road should not exceed predevelopment rates for any storm. Mitigation of the post development runoff should be provided.

BSC Response: The area in front of the duplex townhouses has been regraded to direct more of each driveway and lawn to the trench drains and infiltration systems. This results in peak flow rates to Dorothy Road that do not exceed existing conditions for all storm events analyzed.

12. The top elevation for the proposed rain garden (Pond 3P) is shown as elevation 7.0' in the analysis. The 100-year water service elevation is calculated to be 6.39'. The Grading and Drainage Plan indicated the top elevation as 6.3 indicating the rain garden would overtop in the 100-year storm.

Recommendation: The plans and analysis should be coordinated to accurately reflect the proposed condition.

BSC Response: To more accurately reflect the grading around the rain garden, the 7' elevation has been removed from the HydroCAD with the top of basin elevation set at 6.5 as shown on the Grading Plan. There is a broad crested weir at elevation 6.3 on the west side of the rain garden, which is both modeled in the HydroCAD and shown on the Grading Plan.

13. The bottom elevation of infiltration system INF-1 is proposed to be elevation 6.0'. Groundwater elevation appears to be approximately elevation 3.0'. As noted in previous comments, due to the variation in groundwater at various test pits, BETA recommends that additional test pits be conducted in the infiltration areas during the groundwater season.

Recommendation: Conduct additional test pits to confirm groundwater elevation.

BSC Response: The Applicant will perform additional test pits to confirm seasonal high groundwater prior to application for a building permit. The test pits will be coordinated with the geotechnical investigation for the building and will be conducted during seasonal high groundwater conditions which will be confirmed by monitoring nearby USGS wells.

14. Groundwater mounding calculations are provided for infiltration system INF-1 since the bottom of the system is less than 4 feet above the anticipated groundwater table. The analysis indicates that the lateral extent of the ground water mound will extend to the foundations of four townhouse units as well as the foundation of the senior living building. The mounding is a localized effect and should not impact overall groundwater elevations in the area. However, it should be considered in the design of the building foundations.



BSC Response: Comment is noted and the infiltration system impacts will be considered in the foundation design of the townhouses, garages/carports and the senior living building.

Previous Comments and Responses Provided for Reference

2015 Comprehensive Permit Application

A Comprehensive Permit Application was originally submitted for the proposed Thorndike Place project by the Applicant in 2015. Nover-Armstrong Associates (N-A) conducted a detailed peer review of the application package and issued a peer review letter dated August 10, 2015. Their review letter contained eighteen (18) comments regarding the site plans and application package. The following comments from the 2015 N-A review letter related to civil/site design remain applicable:

15. Eight boring locations are shown on the Existing Conditions Plan C-1 with surface elevations and depths to groundwater noted. Dated and detailed boring logs are not provided on the plans or in the Application making it difficult to evaluate whether the depth of the groundwater observed represents the seasonal high groundwater elevation. The depth to groundwater is presumed to have been measured the day the borings were advanced and may not represent the actual high ground water elevation.
16. Excavated test holes witnessed by a MassDEP Soil Evaluator are necessary to definitively identify the Site's soil types and whether the conceptual project design is generally appropriate for the Site. Boring logs document encountered type soils on the Project Site which help evaluate what types of BMPs would be feasible for the stormwater management system.

Recommendation: The results of any soil borings or test pits done on the project site should be submitted for review. Determination of the seasonal high groundwater elevation is necessary to confirm that the proposed stormwater BMPs are suitable as shown.

BETA 1: Data for three test pits has been provided. Groundwater elevations are shown as varying from -0.5' to 3.0'. The infiltration system designs reflect these groundwater elevations. Two feet of separation to groundwater is provided for Infiltration basin 1. Infiltration Basin 3 should be raised 0.2 feet to provide a full 2-foot separation. Given the variation in groundwater elevation indicated by the test pits, it is suggested that groundwater be confirmed prior to construction. This should be done during seasonal high groundwater conditions.

3/10 BSC Response: In the BSC 1/21/2021 response to the Town Engineer's comments, the Applicant has proposed, as a condition of the Comprehensive Permit, to perform confirmatory on-site testing for groundwater levels during March and/or April 2021 during the expected seasonal high groundwater period. Any modifications to the drainage system design required as a result of new groundwater information will be incorporated into final site plans for review by the Town prior to issuance of building permit.

2020 Comprehensive Permit Application

SITE PLANS

New Comment 1. The Applicant has submitted select plans in response to previous comments. A full set of plans should be submitted to the Board reflecting all changes since the November 2020 submission.

New Comment 2. Based on discussions at the February 4, 2021 working session meeting it appears that the project design may be revised that include.

- Modifications to the building roof line along Dorothy Road and Littlejohn Street.
- Modification to the proposed surface parking on the west side to reduce the overall footprint.



Recommendation: Revised plans and calculations should be submitted to reflect these changes.

3/10 BSC Response: The proposed building and site modifications presented at the February 4, 2021 working session and the February 16, 2021 public hearing along with any other minor modifications in response to further review and comment will be incorporated into the final site plans submitted for review for consistency with the Board's decision or will be coordinated with the appropriate Town Department prior to submission for building permit. The Layout & Materials Plan, Sheet C-103, revised 3/11/21, depicts the proposed changes to the site plan as discussed at the February 4, 2021 working session and as presented at the February 16, 2021 public hearing is provided as an attachment to this letter.

New Comment 3. The stormwater design for the trench drain at the drop-off area in front of the building (Subcatchment 4S) assumes that no runoff bypasses the drain and enters Dorothy Road. The calculated runoff for the 100-year storm is 1.3 cfs.

Recommendation: Calculations should be provided to confirm that the proposed trench drain grate has the capacity to accept this runoff without bypass to Dorothy Road. Alternatively, consideration could be given to revising the driveway grading so that it does not flow to Dorothy Road.

3/10 BSC Response: The proposed trench drain at the courtyard parking area is approximately 70-feet long with a 12-inch grate. The tributary drainage area is only 6,330 square feet (0.15 acres). The inlet capacity of the trench drain is more than adequate to handle the limited runoff from this small area. Final design and sizing calculations will be included with the final site plans submitted for review for consistency with the Board's decision prior to submission for building permit.

1. The proposed erosion control barrier is shown on the Site Preparation plan only.

Recommendation: The applicant should also show the erosion control barrier on the Layout, Grading and Utility Plans.

Applicant's Response 1/21/2021: Response: The erosion control barriers have been added to the Layout, Grading, and Utility Plans. The revised Grading & Drainage Plan is enclosed. The other plans will be submitted under separate cover.

BETA 1: Propose Erosion Controls have been shown on the January 21, 2021 Grading and Drainage Plans.

Recommendation: A complete plan set should be submitted to confirm that this is followed through on all relevant plan sheets. Also, additional erosion controls should be shown for the proposed compensatory flood storage. It is understood that the proposed compensatory storage will be revised to avoid the 25 foot No Disturb Zone of the adjacent wetland.

3/10 BSC Response: Erosion controls, including for the proposed compensatory flood storage area will be shown on the final site plans submitted for review for consistency with the Board's decision prior to submission for building permit.

2. A 15-ft wide pervious paver emergency access drive is shown looping around the rear of the main site building.

Recommendation: The Applicant should confirm that the access drive can accommodate an emergency vehicle (fire truck) turning around the southeast corner of the site building.

BETA 1: No response received



2/16 BSC Response: A truck turning exhibit has been prepared showing the emergency vehicle route, a copy of which is enclosed herein. The turning radius specifications were provided by the Arlington Fire Department.

3. Existing Conditions Plan - The applicant should add a professional surveyor's stamp.

Recommendation: Provide Existing Conditions Plan stamped by a MA Professional Land Surveyor.

BETA 1: No response received

2/16 BSC Response: The Existing Conditions Plan will be stamped by a professional land surveyor and will be included in the final site plans submitted for review for consistency with the Board's decision.

4. General – The applicant proposes to provide stormwater detention/retention on the building roof. The applicant should provide design plans/calcs of the proposed building roof (when developed) for review by an architect and/or structural engineer.

Applicant's Response 1/21/2021: Runoff calculations have been revised to include discharge from the roof detention system in all storms analyzed. This overflow will be at a controlled rate and will flow into the underground infiltration system in the parking lot west of the building. The detailed design of the rooftop detention will be provided as the architectural and plumbing construction plans are developed. In addition, approximately 9,000 square feet of the southeast corner of the building roof will discharge directly to the surface through a roof drain. Please see the enclosed, revised Stormwater Report for additional information and calculations.

BETA 1: The drainage calculations have been revised to include discharge from the roof detention system based on a 4" grate and an 18" diameter connection to Infiltration Basin 1. The calculations indicate a storage depth of 6" – 7" during the 100-year storm.

Recommendation: Additional detail should be provided to confirm the outlet configuration and actual available storage on the roof. Also, maintenance of the outlet needs to be addressed. A single outlet for the roof runoff increases the potential for clogging and failure of the system. The Applicant should also confirm if potential changes to the roofline along Dorothy Road and Littlejohn Street will impact the available roof storage volume.

3/10 BSC Response: As previously stated, the detailed design of the rooftop detention will be provided as the architectural and plumbing construction plans are developed. The detailed design will address the maintenance of the outlet control structure. The architectural design will also include scuppers or downspouts that will operate as an emergency overflow in the event the outlet control structure is clogged during a storm event. Lastly, the proposed changes to the roofline of the building wings fronting on Dorothy Road do not impact the available roof storage volume. The Stormwater Report indicates that 38,000 square feet of the roof area was providing detention. The 38,000 square feet is provided on the 4-story portion of the building.

BETA 6/25: Calculations have been provided for sizing rip-rap outlet protection at the SE roof discharge and the overflow from Infiltration basin 1. The calculations are acceptable.

Recommendation: The dimensions of the aprons should be labeled on the plans and a detail provided.

BSC Response: Rip-rap outlet sizing calculations are being added to the updated Stormwater Report to be submitted under separate cover. Sizing of rip-rap aprons has been added to the Grading and Drainage Plan.



5. The applicant proposed a subsurface “Stormtrap” infiltration chamber system on the west side of the project site. The proposed system is located directly on top of an existing 14-inch sewer line. This presents a potential issue regarding accessing the existing sewer line for future maintenance or repair requirements.

Recommendation: The Applicant should confirm with the Arlington Public Works and/or Sewer Department that the proposed location of the infiltration system is acceptable.

Applicant's 1/21/2021 Response: The system in question has been relocated south of the sewer line to allow Town access should it be needed. Please refer to the enclosed revised Grading & Drainage Plan.

BETA 1: The proposed subsurface infiltration system has been redesigned to avoid the existing sanitary sewer line. Groundwater mounding analysis indicates that the ground water mound will extend beyond the sewer line. However, based on test pit data the sewer is currently below the groundwater table so this should not have a negative impact. Comment resolved.

6. Grading and Drainage Plan – The proposed 15-inch drainpipe from OCS-1 to FES-1 has minimal cover.

Recommendation: The applicant should revise the proposed grading in this area to provide adequate cover over the proposed drain.

Applicant's 1/21/2021 response: This pipe has been reduced in size to 12-inch HDPE and the grading as proposed provides sufficient cover. Please see the enclosed revised Grading & Drainage Plan.

BETA 1: The system has been redesigned and the pipe as proposed has adequate cover. Comment resolved.

7. Grading and Drainage Plan – The applicant proposes an entrance door to the garage level on the east side of the building, the proposed finished grade elevation is 2.83. The seasonal high groundwater elevation of the site development area is presumed to be around elev. 3.0 based on past soil borings.

Recommendation: The applicant should confirm the seasonal high groundwater elevation in this area and provide appropriate mitigative measures if necessary, to prevent surface water from entering the garage through the doorway.

BETA 1: No response received. However additional test pit data was submitted indicating groundwater elevations at 0.2 feet in the vicinity of the garage opening. As previously noted, groundwater elevations should be confirmed prior to construction.

2/16 BSC Response: The project architect is reviewing options to raise the elevation of the garage entrance door on the east side of the building above the seasonal high groundwater elevation. The change in elevation will be accomplished with an internal ramp. Additionally, test pits conducted on the site demonstrate groundwater to be at El. = 3.0. The applicant has proposed as a condition of the Comprehensive Permit to perform confirmatory on-site testing for groundwater levels during March and/or April 2021 during the expected seasonal high groundwater period.

3/10 BSC Response: In addition to the mitigative measures described above, the project architect is reviewing an additional option to enclose the exterior portion of the ramp along the east wall of the building and providing the entrance door at approximately elevation 7.0.

8. Areas for trash collection and snow storage are not identified on the site plan.

Recommendation: The Applicant should identify potential areas for trash collection and snow storage on the site plan to confirm that these will not conflict with other site elements.

BETA 1: No response received.



2/16 BSC Response: The proposed location of the trash room in the basement level is shown on Sheet C-104 of the site plans and the Garage Plan in the architectural drawings. All trash and recycling facilities are located on the garage level. Building management staff will wheel out trash and recycling on trash/recycling days to a location on the south side of the garage vehicular ramp where it will be removed by waste haulers.

Snow storage for the surface parking lot and primary access drive will be provided off the pavement on the west side of the parking lot. Snow storage for the courtyard entrance will be provided off pavement within landscape areas and to the east and west of the courtyard between the building and back of sidewalk. Any excess snow will be removed and properly disposed of offsite.

The trash/recycling collection areas and designated snow storage areas will be depicted in the final site plans submitted for review for consistency with the Board's decision.

9. Civil and Landscape Details (sheet 1) – The applicant has provided a Silt fence with Haybales erosion control barrier detail.

Recommendation: The applicant should utilize an 18-inch diameter compost filled silt sock with silt fence in lieu of staked haybales for erosion control measures.

Applicant's 1/21/2021 Response: The perimeter erosion controls have been revised as recommended and are shown on the enclosed revised Site Preparation Plan and Grading & Drainage Plan. A detail of the 18-inch diameter compost-filled silt sock with silt fence has been added to the enclosed Civil and Landscape Details (Sheet C-200).

BETA 1: Revisions are acceptable. Comment resolved.

10. The applicant should provide a detail of the proposed Outlet Control Structures #1 and #2. Also, the applicant should review OCS-2 as it appears that the structure is too shallow to be constructed as shown.

Applicant's 1/21/2021 Response: The revised stormwater management system only includes one outlet control structure (OCS, previously designated at OCS-2), as shown on the revised Grading & Drainage Plan. This structure is a 6-foot diameter manhole with an outlet pipe higher than the inlet pipe. A detail has been added to the enclosed Civil & Landscape Details Sheet C-203.

BETA 1: The drainage system design has been revised. A detail of OCS-1 is provided. It is suggested that the detail on Sheet C-203 be revised to more accurately depict that the invert of the 12" outlet pipe is at the top of the 30" inlet. The function of OCS-1 is not clear as the drainage calculations show no discharge from infiltration basin 3 during the 100-year storm.

3/10 BSC Response: The detail shown on Sheet C-203 will be revised to accurately show the invert of the 12" outlet pipe at the top of the 30" inlet. The revision will be incorporated in the final site plans submitted for review for consistency with the Board's decision. The function of OCS is to provide an emergency overflow for the underground detention system draining the garage ramp.

11. Recommend the applicant adjust the location of the proposed pedestrian ramp on the west side of the site building so that it is located within the proposed crosswalk crossing the site access drive.

BETA 1: No response received

2/16 BSC Response: BSC concurs with this recommendation. The location of the proposed pedestrian ramp on the west side of the building will be relocated to align with the proposed crosswalk crossing the site access drive and will be depicted in the final site plans submitted for review for consistency with the Board's decision.



12. Recommend the applicant confirm that any footing of the proposed retaining wall near the driveway garage entrance will not conflict with the existing drainage pipe located in the same area.

Applicant's 1/21/2021 Response: The garage ramp retaining wall and associated grading have been revised to eliminate any potential conflict with the existing drainage pipe and is shown on the revised Grading & Drainage Plan.

BETA 1: The retaining wall has been shortened to avoid impacting the existing drain. To accomplish this the slope of the driveway has been increased from about 5% to about 8%. No further comment.

FLOOD PLAIN

13. A portion of the proposed project design requires filling within the 100-year flood plain. Compensatory storage is required on a 1:1 (per foot) basis by the Mass Wetlands Protection Act (310 CMR 10.57) and on a 2:1 basis by the Arlington Wetlands Bylaw.

The applicant has provided compensatory flood plain storage calculations in the stormwater report (Sec. 2.12) and has designated an upland area on the site plan southeast of the proposed building for compensatory storage. In addition, the southeast courtyard area is labeled "Open Space / Flood Storage".

BETA's wildlife biologist reviewed the revised plans to evaluate the impacts of the newly proposed compensatory flood storage areas. These areas both located south/ southeast of the main building in a heavily wooded area on the site. Currently these regions are densely vegetated and upslope of isolated wetland WF-D series. This serves as a water filtration system to the downstream wetlands as well as preventing erosion by holding on to sediment and slowing stormwater. However, the vegetation is mostly invasive species and an abundance of dead trees. While the dense vegetation and standing deadwood provides good nesting habitat, this feature exists in other areas of the property.

Constructing these compensatory flood storage areas will most likely involve clearing any existing vegetation and re-grading the area creating the opportunity to replant and seed the area with native species to add productivity to the remaining area. Dense shrubs such as high bush blueberry can provide dense cover and food sources for wildlife for example. Pollinator species should also be considered to replace what will be lost in the surrounding area during clearing. This will also be an important feature for retaining water and nutrients in these areas and prevent standing water which is a breeding ground for insects.

Recommendation: The Applicant should provide a plan graphic showing the existing flood plain area being altered by the proposed building / site development, currently the building hatch is obscuring the flood plain limits. The proposed compensatory flood storage volume calculations and designated flood storage volume area appear consistent.

BETA 1: No response received. We understand that the compensatory flood plain storage will be revised to avoid impact to the 25 foot No Disturb zone of the adjacent wetland.

2/16 BSC Response: A floodplain impacts and compensatory storage exhibit was previously submitted. A revised floodplain impacts and compensatory storage exhibit considering the Isolated Vegetated Wetlands (IVW) and AURA is attached. The proposed compensatory storage areas located within the AURA to BVW or IVW have been located, where possible, within the outer 50 feet of the AURA. This work is also considered a temporary disturbance area and once the compensatory storage work is complete, it will return to its natural function as AURA and Land Subject to Flooding.

BSC Response: We believe that the locations proposed for compensatory storage provide an opportunity to improve the overall site and help protect nearby resource areas. Please see or response



to Comment 5 at the start of this response as well as our previous response to this comment for more detail.

STORMWATER MANAGEMENT

14. The Applicant should provide onsite soil exploration / test pit data for review, specifically within the footprints of the two proposed subsurface infiltration chambersystems. The test pit data is required at a minimum to determine the seasonal high groundwater elevations within the project limits.

Applicant's 1/21/2021 Response: In November 2020, BSC performed three soil test pits on site. The results of these test pits confirmed the soils mapping and previously performed borings with regard to seasonal high groundwater. Locations of the test pits are shown on the enclosed revised Grading & Drainage Plan. Test pit logs are included in Appendix D and more detailed information is provided in Section 1.02 of the revised Stormwater Report.

BETA 1: Data for three test pits has been provided. Groundwater elevations are shown as varying from -0.5' to 3.0'. The infiltration system designs reflect these groundwater elevations. Two feet of separation to groundwater is provided for Infiltration basin 1. Infiltration Basin 3 should be raised 0.2 feet to provide a full 2-foot separation. Given the variation in groundwater elevation indicated by the test pits, it is suggested that groundwater be confirmed prior to construction. This should be done during seasonal high groundwater conditions.

3/10 BSC Response: In the BSC 1/21/2021 response to the Town Engineer's comments, the Applicant has proposed, as a condition of the Comprehensive Permit, to perform confirmatory on-site testing for groundwater levels during March and/or April 2021 during the expected seasonal high groundwater period. Any modifications to the drainage system design required as a result of new groundwater information will be incorporated into final site plans for review by the Town prior to issuance of building permit.

15. The proposed site building roof will be designed to provide stormwater detention, with a roof drain connection to the proposed subsurface infiltration chamber system #1 located west of the building. The HydroCAD model included with the Stormwater Report shows zero runoff leaving the roof area for all storms up to and including the 100-year design storm. Discussions with the applicant indicate the disposition of this retained stormwater has not yet been finalized. Until the disposition of the retained rooftop stormwater is known, its effects on the proposed stormwater BMPs cannot be evaluated.

Applicant's 1/21/2021 Response: Runoff calculations have been revised to include discharge from the roof detention system in all storms analyzed. This overflow will be at a controlled rate and will flow into the underground infiltration system in the parking lot west of the building. The detailed design of the rooftop detention will be provided as the architectural and plumbing construction plans are developed. In addition, approximately 9,000 square feet of the southeast corner of the building roof will discharge directly to the surface through roof a roof drain. Please see the enclosed, revised Stormwater Report for additional information and calculations.

BETA 1: See response to Comment 4. Additional information should be provided as the architectural plans are developed to confirm that the roof detention will function as shown in the calculations.

3/10 BSC Response: See 3/10 BSC Response to Comment 4 above.

16. The proposed infiltration chamber system #1 receives stormwater from a proposed CB located between the site access drive and proposed parking area west of the site building. The rim elevation of this CB is 8.0. The results of the HydroCAD model indicate that the 50-yr flood elevation within the infiltration



system is elev. 8.28. This flood elevation will cause stormwater to surcharge out of the CB grate and overflow down the access driveway to the lower garage level.

Recommendation: The Applicant should reevaluate the proposed infiltration chamber system #1 to provide adequate stormwater capacity so that there is no on-site surface surcharge for any of the proposed design storms.

Applicant's 1/21/2021 Response: The infiltration system has been revised, both in footprint and storage volume and the area around the catch basin regraded (rim elevation 8.84) so that no surcharge will occur. Please refer to the enclosed revised Grading & Drainage Plan.

BETA 1: The proposed grading has been revised on the 1/21/2021 Grading & Drainage plan so that the CB rim is above the 100-year water surface elevation in infiltration basin 1. Comment resolved.

17. The proposed infiltration chamber system #2 located near the southwest corner of the site building receives stormwater from a proposed trench drain located across the access driveway to the lower garage level. The rim elevation of the proposed trench drain is 4.1. The results of the HydroCAD model indicate that the 2-yr flood elevation within the infiltration chamber system is elev. 8.40. This is not possible. The applicant is currently reevaluating the design of Infiltration Chamber System #2.

Applicant's 1/21/2021 response: the proposed system has been resized and the area around the trench drain regraded so that no surcharge will occur.

BETA 1: The rim elevation of the driveway trench drain has been revised to be 0.18 feet above the 100-year water surface elevation in Infiltration basin 3 to avoid surcharging to the driveway surface. However, the infiltration basin bottom should be raised 0.2 feet to provide the required 2-foot separation to groundwater. This may require adjustment of the trench drain rim elevation.

3/10 BSC Response: as stated in the response to Comment 14 above, the Applicant has proposed, as a condition of the Comprehensive Permit, to perform confirmatory on-site testing for groundwater levels during March and/or April 2021 during the expected seasonal high groundwater period. Any modifications to the drainage system design required as a result of new groundwater information, including raising the bottom elevation of infiltration areas, will be incorporated into final site plans for review by the Town prior to issuance of building permit.

18. The applicant should provide groundwater mounding calculations as the two proposed infiltration chamber systems are designed to provide peak rate mitigation and appear to be within 4-ft of estimated seasonal high groundwater.

Applicant's 1/21/2021 Response: A groundwater mounding analysis of the underground recharge system has been performed and is included in Section 6.05 of the Stormwater Report. The analysis shows that the groundwater mound is less than the provided separation to groundwater.

BETA 1: A mounding analysis has been provided for Infiltration Basin 1. The mounding analysis adequately represents anticipated conditions. The expected vertical extent of the mound will be below the bottom elevation of the basin. The expected horizontal extent of the mound dissipates before it reaches any adjacent existing foundations.

19. The HydroCAD model included in the stormwater report analyzes the proposed stormwater BMPs over a 24-hr time period.

Recommendation: The applicant should increase the analysis time period to 72 hours to allow the BMPs to demonstrate their drain down capacity after the storm event concludes.



Applicant's 1/21/2021 Response: The analysis time period has been extended to 72- hours as requested. In addition, a drawdown calculation in accordance with Volume 3, Chapter 1 of the Massachusetts Stormwater Handbook has been performed demonstrating that the infiltration system will drain within 72-hours. This information is included in Section 6.02 of the accompanying Stormwater Report.

BETA 1: The drawdown calculations have been provided and are acceptable. Comment resolved.

20. MassDEP Stormwater Standard #10 – The applicant should provide a signed Illicit Discharge Compliance statement.

Applicant's 1/21/2021 Response: An illicit discharge compliance statement has been included in Section 6.06 of the Stormwater Report and will be signed by the Applicant prior to issuance of permits.

BETA 1: The Illicit Discharge Statement has been provided. Comment resolved.

UTILITIES

21. The applicant proposes some drain manholes (DMH-2, 3) requiring shallow installations. For these applications the applicant should confirm the frame/cover height (standard 8-in, shallow 4-in) and that adequate cover exists over the inlet/outlet pipes for constructability.

BETA 1: No response received

2/16 BSC Response: DMH-2 and 3 have been eliminated in the revised stormwater management system design as submitted to the Board and The BETA Group on January 25, 2021.

22. The Utility Plans show the proposed utility services from the project site to the existing municipal/gas/electric utilities in Dorothy Road.

Recommendation: We recommend the Applicant coordinate with the Arlington Public Works Department and local utility companies regarding all proposed site utility connections to the public utilities in Dorothy Road to confirm compliance with applicable construction standards.

BETA 1: No response received.

2/16 BSC Response: A detailed plan review and comments was provided by the Town Engineer. Responses to those comments are provided below.

23. The existing survey shows an existing drain line in Dorothy Road that runs in front of the project site. The Utility Plan shows three proposed sewer service lines from the building to the existing municipal sewer in Dorothy Road that cross the drain line.

Recommendation: The Applicant should confirm the proposed sewer services as shown do not conflict with the existing drain line.

BETA 1: No response received.

2/16 BSC Response: The existing sewer line that runs within the easement across the property frontage on Dorothy Road has an invert of approximately elevation = 1.7 to 1.2. The proposed building sewer laterals have invert elevations = 5.22 to 4.33; providing a minimum of 1 foot separation where crossing the existing sewer.

CONSTRUCTION

New Comment 1. It is suggested that prior to construction, the Applicant prepare a Construction Management Plan (CMP) for review and approval by the Board. The CMP will provide documentation of various construction related activities. The CMP should include:

- Project Description and outline of primary construction tasks



- Project Schedule including hours of operation, duration of primary construction tasks and estimated completion date
- Project logistics including staging areas, truck routes, laydown areas, contractor parking and traffic management
- Site Management including noise mitigation, dust control and security
- Public Safety and Coordination including contact information and site inspections

3/10 BSC Response: A Construction Management Plan (CMP), containing the information above, will be prepared by the General Contractor and submitted to appropriate Town staff prior to issuance of building permit.

New Comment 2. The Long Term Pollution Prevention & Operations and Maintenance Plan should include requirements for inspection and cleaning of trench drains and the roof stormwater outlet to ensure these are functional prior to significant rain events.

3/10 BSC Response: The Long-Term Pollution Prevention & Operation and Maintenance Plan will be updated to include requirements for the inspection and cleaning of the trench drains and roof detention outlet control structure. The inspection and cleaning requirements will be included in the revised Stormwater Report to be included with the final site plans submitted for review for consistency with the Board's decision prior to submission for building permit.

New Comment 3. The Long Term Pollution Prevention & Operations and Maintenance Plan should include provisions for maintenance and cleaning of compensatory flood storage areas to ensure these remain functional.

3/10 BSC Response: It is not appropriate for the maintenance and cleaning of the compensatory flood storage areas to be included in the Long-Term Pollution Prevent & Operation and Maintenance Plan. Requirements for the compensatory flood storage areas will be addressed in the recommended conditions provided by BETA and the Arlington Conservation Commission.

24. Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan –Section 3.10.4 Equipment/Vehicle Maintenance and Fueling Areas:

Recommendation: BETA recommends adding a provision prohibiting refueling of vehicles or equipment within 100-feet of any onsite resource area.

Applicant's 1/21/2021 Response: A prohibition on refueling and maintenance has been added in Section 3.10.5 of the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan as recommended.

BETA 1: Information provided. Comment resolved.

25. Recommend the applicant add a provision to the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan that "Dorothy Road shall be swept clean on a daily basis of any soils tracked onto it from the project site".

Applicant's 1/21/2021 response: A daily sweeping requirement has been added in Section 3.10.1 of the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan as recommended.

BETA 1: Information provided. Comment resolved.

26. As part of a Construction Management Plan the applicant should develop a map of approved haul routes for trucks traveling to/from the project site during construction as the immediate site vicinity is comprised of narrow residential streets.



Jenny Raitt, Director

August 3, 2021

Page 15

3/10 BSC Response: As provided in the 1/25/2021 BSC response to BETA Traffic Impact Assessment comments, the Construction Management Plan will include a Construction Traffic Management Plan that will include construction vehicle access routes, hours of construction and temporary parking restrictions. The Construction Traffic Management Plan will be prepared by the General Contractor and submitted to appropriate Town staff prior to issuance of building permit.

RESOURCE AREAS

3/10 BSC Response: BETA has provided recommended conditions related to compensatory flood storage mitigation, vegetation replacement, invasive species management, and no work within the 25-foot No Disturb Zone. The proposed conditions are consistent with conditions proposed by the Arlington Conservation Commission (ACC). The Applicant's responses to the ACC proposed conditions will be provided under separate cover and are not included here.

We believe these responses fully address all outstanding BETA Civil and Wetland Peer Review comments. Should you have any questions on this information, please do not hesitate to reach out to me at (617) 896-4386 or drinaldi@bscgrop.com.

Sincerely,
BSC Group, Inc.

Dominic Rinaldi, P.E., LEED AP BD+C
Senior Associate

cc: zba@town.arlington.ma.us

Christian Klein, Chair, Arlington ZBA
Marta Nover and William McGrath, BETA
Paul Haverty, Blatman, Bobrowski & Haverty, LLC
Stephanie Kiefer, Smolak & Vaughan
Gwen Noyes and Arthur Klipfel, Arlington Land Realty

Attachments: Layout & Materials Plan, Sheet C-103
Grading & Drainage Plan, Sheet C-105
Utility Plan, Sheet C-106
Potential Conservation Parcel Exhibit
Vehicle Turning Exhibits

August 3, 2021

Ms. Jennifer Raitt
Director of Planning and Community Development
Town of Arlington
730 Massachusetts Avenue Annex
Arlington, MA 02476

Re: Responses to Peer Review Comments
Thorndike Place Development Changes
Arlington, Massachusetts

Dear Ms. Raitt:

Vanasse & Associates, Inc. (VAI) is pleased to submit responses to the June 28, 2021 letter from BETA Group, Inc. (BETA), the Town of Arlington's Peer Review consultant for the above-referenced development. For ease of review, we have listed the initial comments followed by our initial responses in italics. It should be noted that only comments that required a response are listed in this letter.

BETA Peer Review Letter – June 28, 2021

Comment No. 1: *“BETA concurs that the proposed Project Plan will represent a reduction in Project trips when compared to the previous Project Plan.*

“It is noted that the Applicant’s traffic evaluation conservatively evaluated Land Use Code 252 – Senior Adult Housing – Attached. As per ITE, this land use assumes internal services are not provided with residents typically living a more active independent lifestyle. The discussion presented by the Applicant on June 10, 2021 suggests the facility may function more consistent with LUC 253 – Congregate Care Facility. This land use provides internal services for residents that typically do not drive. As a result, trips are typically generated by employees/staff, visitors, or group transportation. BETA notes that LUC 253 generates fewer trips and less parking demand than Senior Adult Housing – Attached.”

Response: We are encouraged that BETA agrees with our conclusion that the revised project will have a reduction in Project trips when compared with the previous development plan.

Comment No. 2: *“The Assessment incorporated Mode Share as reported by the US Census Journey to Work. BETA finds this methodology to be unreasonable for the senior housing land use. That said, discounting the effect of the Mode Share exercise continues to result in a decrease in trip generation when compared with the previous project plan.”*

Response: It is not clear how BETA arrives at this conclusion of discounting the use of the Census data for mode share for the development, as no justification was provided for dismissing the use of any mode split data. It is noted that the development is an Independent Living complex, and most residents are expected to be fully mobile and

active adults and able to use other forms of transportation including public transit, pedestrian, and bicycles. Other services such as the Arlington Council on Aging transport van and the proposed jitney service are likely to reduce the reliance on personal vehicles. In VAI's updated analysis to the Arlington Zoning Board of Appeals dated August 2, 2021, a mode split adjustment to auto use representing half of the non-auto use mode share from the Census data was utilized. This still represents a conservative treatment of project trips, but one that is expected to be more realistic given the numerous opportunities for transportation in the area.

Comment No. 3: *"BETA evaluated the ITE Parking Generation Manual, 5th Edition, for LUC 252 – Senior Adult Housing – Attached, which estimates a typical demand of approximately 75 parking spaces for 124 units. The Town of Arlington Zoning Bylaw requires a minimum of 50 parking spaces for a 124 unit "Assisted Living Residence." This suggests the proposed parking supply is adequate."*

Response: We concur with BETA's conclusion that the proposed parking supply is adequate. ITE notes a demand of 75.68 (76) spaces for the 124 units and the Project will provide 96 spaces, allowing 20 surplus spaces over the ITE methodology. It should be noted that the ITE data includes all users of the development, including residents, visitors, and staff.

In addition to the non-numbered comments above, BETA requested additional points of clarification related to the site plans in comments numbered 1-7 in its Review Letter. Please refer to updated site plans provided by The BSC Group (BSC). Responses to these comments are provided below.

Comment No. (1): *"Clarify the number of accessible spaces required for the property, noting that the intended use will be Senior Living."*

Response: The garage level will include eight (8) accessible spaces and the surface parking will include two (2) accessible parking spaces, located next to the main entrance door.

Comment No. (2): *"The proposed garage utilizes a parking "pod" of one compact space and two standard spaces between parking garage columns. Clarify whether parking maneuvers and space sizing is adequate noting the intended residents."*

Response: It should be noted that there is no standard for adequacy of parking spaces for senior residents. However, the garage has been designed with a wider than standard drive aisle of 24'8" and compact spaces are 8'x18' rather than the typical 8'x16' dimensions. Lighting in the garage will be high visibility LED lighting to improve visual acuity for residents.

Comment No. (3): *"Clarify aisle and parking widths on the east side of the parking garage."*

Response: As identified on plans prepared by the Project Architect, the aisle widths throughout the parking garage are 24'8", which is slightly in excess of the required aisle width under the zoning bylaw (24'). The parking "pod" layout design likewise is carried out through the parking garage, with 24 compact spaces (8'x18'), 52 standard (8.5' x 18') and 8 handicap access spaces, within the garage.

Comment No. (4): *"The Applicant expects organized senior transportation. Clarify that the senior transportation vehicle can adequately circulate around the parking area."*

Response: The Applicant anticipates residents will make use of both senior transportation as well as the on-site jitney service. See AutoTurn analysis conducted by BSC for these vehicles, shown on plans labeled Sheet SK-01 through Sheet SK-04.

Comment No. (5): *"Senior housing typically generates more emergency response calls than traditional housing. Clarify that emergency vehicles can circulate around the parking area."*

Response: See AutoTurn analysis conducted by BSC for these vehicles, shown on plans labeled Sheet SK-01 through sheet SK-04.

Comment No. (6): *"Parallel parking on the west side of the main driveway will be required to circulate in front of the main entry or make a maneuver within the garage area to exit the site. Clarify that adequate maneuverability is provided within the circle at the main entry."*

Response: The parallel parking has been revised to be 90 degree (head-in) parking. The revised design allows for a vehicle to enter and exit the Property without navigating around the main entry circle, reducing internal traffic.

Comment No. (7): *"Interior (middle) duplex units will share a common driveway that can provide two parking spaces per unit (tandem). It is expected that one vehicle could be parked in the carport and one vehicle can be parked in the driveway. Outside units provide one parking space behind the structure, accessible by either the paved emergency access drive (east side) or primary access drive (west side). Ensure that resident parking does not restrict either access driveway."*

Response: The parking spaces (2) behind the westernmost duplex unit is off the access drive. The driveway to this unit has been designed to allow for vehicles to enter and exit from the main access drive. The easternmost duplex unit will have one parking space, located off the emergency access drive. Entry and exit into the parking area is provided from the emergency drive. While the emergency access drive is 20 feet wide, it will not be used by other vehicles other than the unit owner of the eastern duplex and, in the event of a fire in which access to the rear of the building is required, by a fire truck. "No Parking" markings have been provided on the Layout Plan Sheet C-103 prepared by BSC.

Sincerely,

VANASSE & ASSOCIATES, INC.



Scott W. Thornton, P.E.
Principal

cc: File

Ref: 8451

August 3, 2021

Arlington Zoning Board of Appeals
Town of Arlington
730 Grove Street
Arlington, MA 02476

Re: Revised Traffic Analysis and Response to ZBA Comments
Thorndike Place Development Changes

Dear Zoning Board of Appeals:

Vanasse & Associates, Inc. (VAI) has prepared this letter in order to respond to comments from the Arlington Zoning Board of Appeals (ZBA) regarding the revisions to the proposed Thorndike Place development changes (the "Project"). The development program now consists of townhouses and senior independent living residences. VAI was requested to provide updated trip-generation calculations, updated capacity analyses, parking demand calculations, and emergency response vehicle truck turning figures for the current development program. The following provides a summary of the requested updated calculations and analyses.

TRIP-GENERATION

The current proposed development program calls for the construction of 12 townhouse units and 124 senior housing independent living units. In order to develop the traffic characteristics of the proposed Project, trip-generation statistics published by the Institute of Transportation Engineers (ITE)¹ for Land Use Code (LUC) 220, *Multifamily Housing (Low-Rise)* and LUC 252, *Senior Adult Housing - Attached* were used.

The ITE trip estimations were then utilized in conjunction with mode split percentage from U.S. Census data in order to provide an estimate of person trip generation for the Project. The mode split data were obtained from U.S. Census and American Community Survey for Census Tract 3561, the census tract in which the project is located. The mode split data from the census are provided in Table 1.

¹*Trip Generation*, 10th Edition; Institute of Transportation Engineers; Washington, DC; 2017.

Table 1
MODE SPLIT DATA

Mode	Census Tract 3561 Mode Splits ^a (Percentage)
Single Occupancy Vehicle	43
High Occupancy Vehicle	11
Transit	32
Bike	6
Walk	0
Other	8
TOTAL	100

^aFrom from American Community Survey 2018 5-year estimates for Census Tract 3561.

The mode split data was then applied to the ITE trip-generation projections for the townhouse units to determine the trips by mode. A summary of the expected site-generated trips by mode is provided in Table 2 for the townhouse units (LUC 220).

Table 2
TRIP-GENERATION SUMMARY: TOWNHOUSES

Time Period/ Directional Distribution	Townhouses Vehicle Trips ^a	Townhouses Person Trips ^b	SOV Trips 43%	HOV Trips 11%	Transit Trips 32%	Bike Trips 6%	Walk Trips 0%	Other Trips 8%	Townhouses Total Vehicle Trips ^c
Weekday Daily	88	100	43	11	32	6	0	8	48
<i>Weekday Morning Peak Hour:</i>									
Entering	1	1	1	0	0	0	0	0	1
Exiting	5	6	2	1	2	0	0	1	3
Total	6	7	3	1	2	0	0	1	4
<i>Weekday Evening Peak Hour:</i>									
Entering	4	5	2	1	2	0	0	0	3
Exiting	3	3	1	0	1	0	0	1	1
Total	7	8	3	1	3	0	0	1	4

^aBased on ITE LUC 220, *Multifamily Housing (Low-Rise)*; 12 units.

^bITE vehicle trips multiplied by VOR from American Community Survey 2018 5-year estimates for Census Tract 3561; VOR = 1.13.

^cSOV+HOV persons trips divided by VOR from American Community Survey 2018 5-year estimates for Census Tract 3561; VOR = 1.13.

The trips anticipated to be generated by the senior housing units were also adjusted to account for utilization of different modes of transportation. The Town's Peer Review consultant commented that the use of the census tract mode shares is unreasonable for the senior housing land use. VAI respectfully disagrees with this opinion and notes that the transit services and multi-use pathways in close proximity to the site will

encourage the use of alternative transportation. The Applicant will promote the site's access to alternative transportation facilities (Minuteman Bikeway, Alewife Station) in advertising materials for the site and some prospective residents are likely to choose the development precisely because of its location near these facilities. To address the peer reviewer's concerns, it was assumed that the senior housing units would have a non-auto mode split only equal to half of that indicated by the census tract data. The census tract indicates a non-auto mode share of 46 percent; therefore, a 23 percent adjustment was taken for the senior housing units for non-auto use. The adjusted trip generation for senior housing units (LUC 252) is provided in Table 3.

Table 3
TRIP-GENERATION SUMMARY:
SENIOR HOUSING-INDEPENDENT LIVING

Time Period/ Directional Distribution	Senior Housing Total Trips ^a (124 Units)	Senior Housing Non-Auto Trips ^b	Senior Housing Auto Trips ^c
Weekday Daily	474	110	364
<i>Weekday Morning Peak Hour:</i>			
Entering	9	2	7
Exiting	<u>16</u>	<u>4</u>	<u>12</u>
Total	25	6	19
<i>Weekday Evening Peak Hour:</i>			
Entering	18	5	13
Exiting	<u>14</u>	<u>3</u>	<u>11</u>
Total	32	8	24

^aBased on ITE LUC 252, *Senior Adult Housing – Attached*.

^bAssumed that senior housing mode split for non-auto would be half of what Census Tract 3561 indicates (46 percent); Senior housing non-auto mode split = 23 percent.

^cSenior housing auto mode split = 77 percent.

The overall expected site-generated vehicle trips are summarized in Table 4 and graphically depicted on Figures 8RR and 9RR.

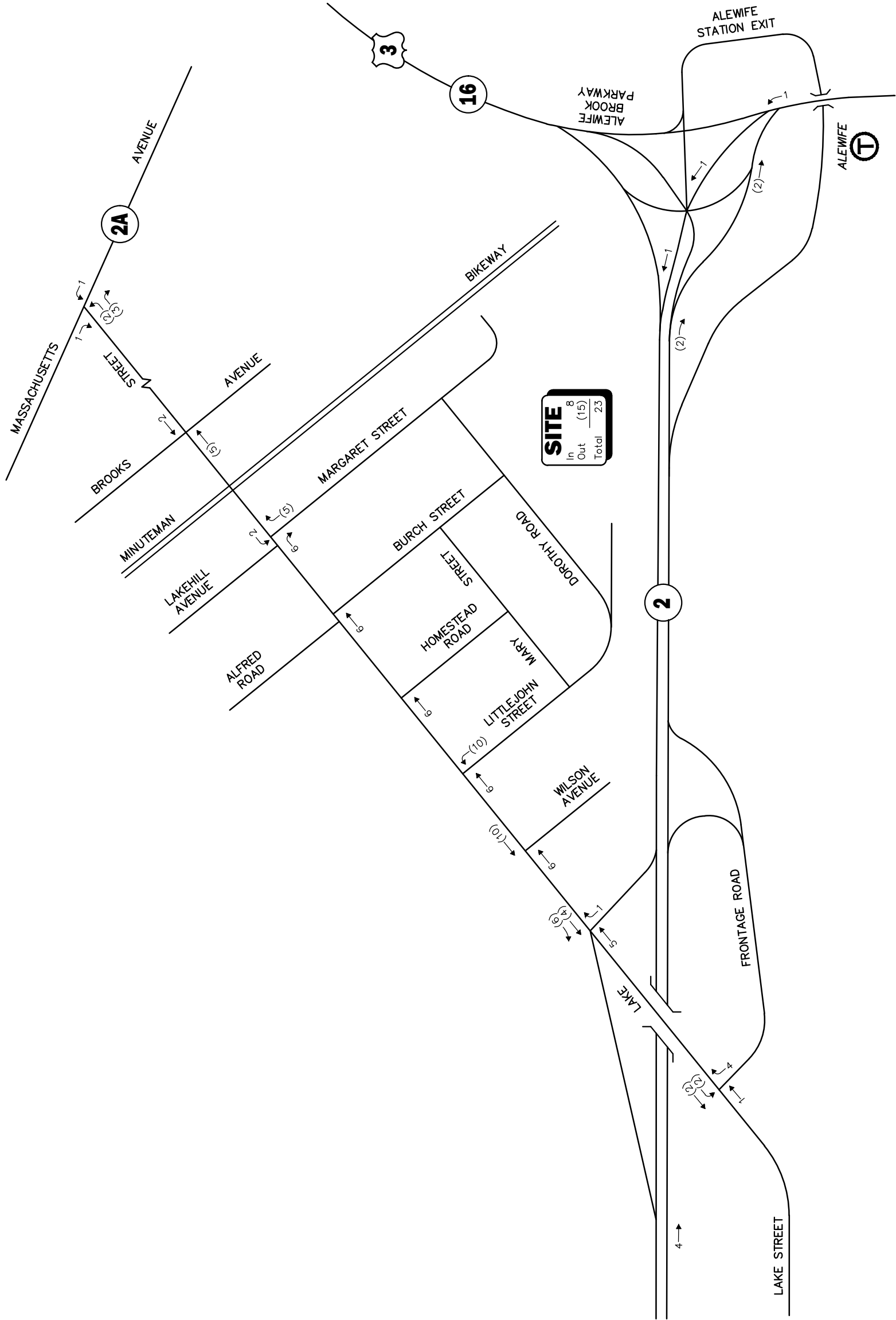
Legend:

XX

Entering Trips

(XX)

Exiting Trips



Vanasse & Associates inc

Figure 8RR

Site Generated
Weekday Morning
Peak Hour Traffic Volumes

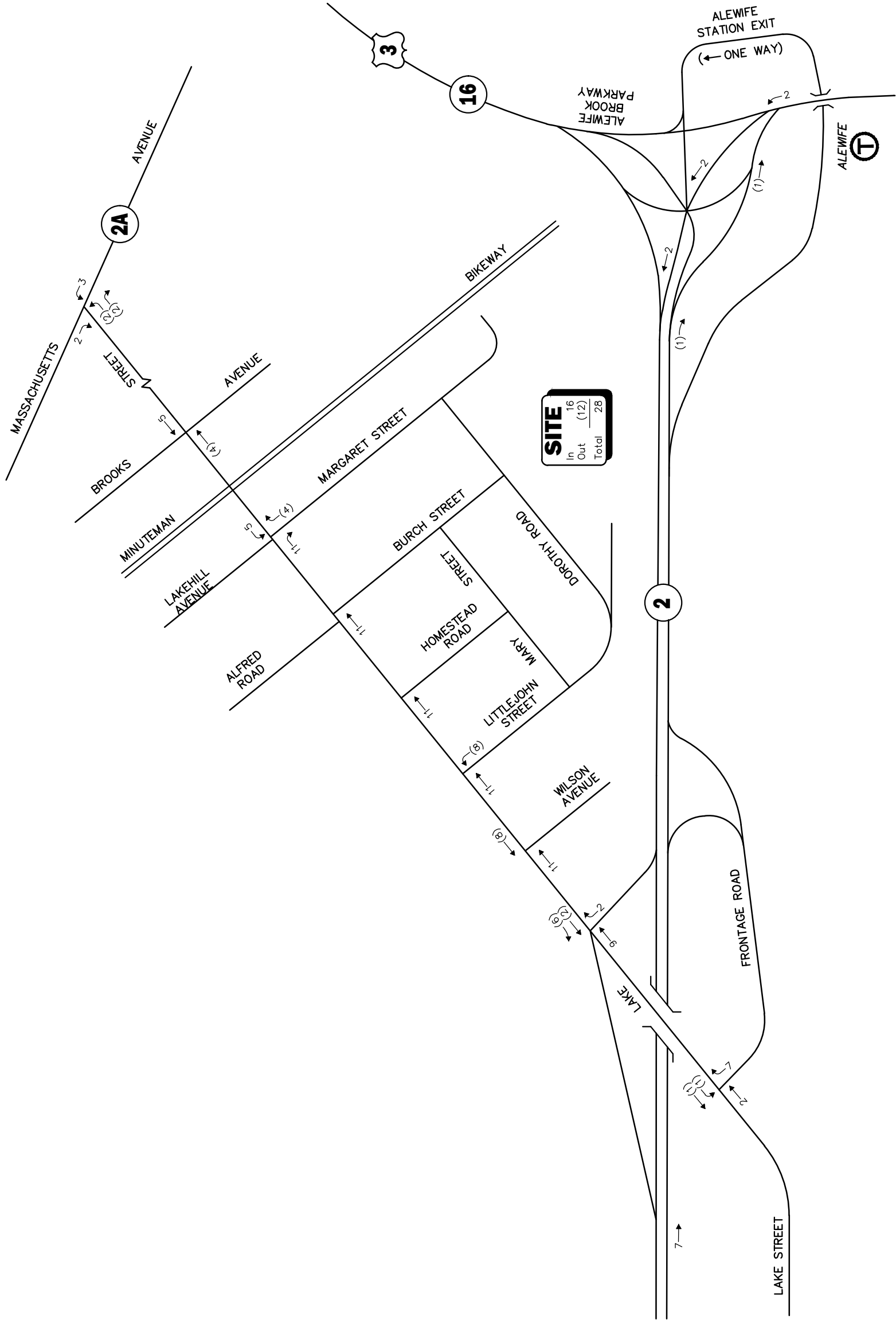
Legend:

XX

Entering Trips

(XX)

Exiting Trips



Not To Scale

Vanasse &
Associates inc

Figure 9RR

Site Generated
Weekday Evening
Peak Hour Traffic Volumes

Table 4
TOTAL VEHICLE-TRIP-GENERATION SUMMARY

Time Period/ Directional Distribution	Townhouses Vehicle Trips ^a	Senior Housing Vehicle Trips ^b	Project- Generated Vehicle Trips
Weekday Daily	48	364	412
<i>Weekday Morning Peak Hour:</i>			
Entering	1	7	8
<u>Exiting</u>	<u>3</u>	<u>12</u>	<u>15</u>
Total	4	19	23
<i>Weekday Evening Peak Hour:</i>			
Entering	3	13	16
<u>Exiting</u>	<u>1</u>	<u>11</u>	<u>12</u>
Total	4	24	28

^aFrom Table 2.

^bFrom Table 3.

As can be seen in Table 4, the Project is expected to generate 412 vehicle trips on an average weekday (two-way, 24-hour volume), with 23 vehicle trips (8 entering and 15 exiting) expected during the weekday morning peak hour and 28 vehicle trips (16 entering and 12 exiting) expected during the weekday evening peak hour.

The trip generation of the 176-unit apartment complex program evaluated in the November 2020 Transportation Impact Assessment (TIA) for Thorndike Place is listed in Table 5 for comparison to the current development program.

Table 5
PROJECT-GENERATED VEHICLE-TRIP-GENERATION COMPARISON

Time Period/ Directional Distribution	Current Program Vehicle Trips ^a	Previous Program Vehicle Trips ^b	Increase/Decrease Vehicle Trips	Increase/Decrease Percent
Weekday Daily	412	430	-18	-4
<i>Weekday Morning Peak Hour:</i>				
Entering	8	7	+1	--
<u>Exiting</u>	<u>15</u>	<u>20</u>	<u>-5</u>	<u>--</u>
Total	23	27	-4	-15
<i>Weekday Evening Peak Hour:</i>				
Entering	16	20	-4	--
<u>Exiting</u>	<u>12</u>	<u>13</u>	<u>-1</u>	<u>--</u>
Total	28	33	-5	-15

^aFrom Table 4.

^bFrom November 2020 TIA for Thorndike Place.

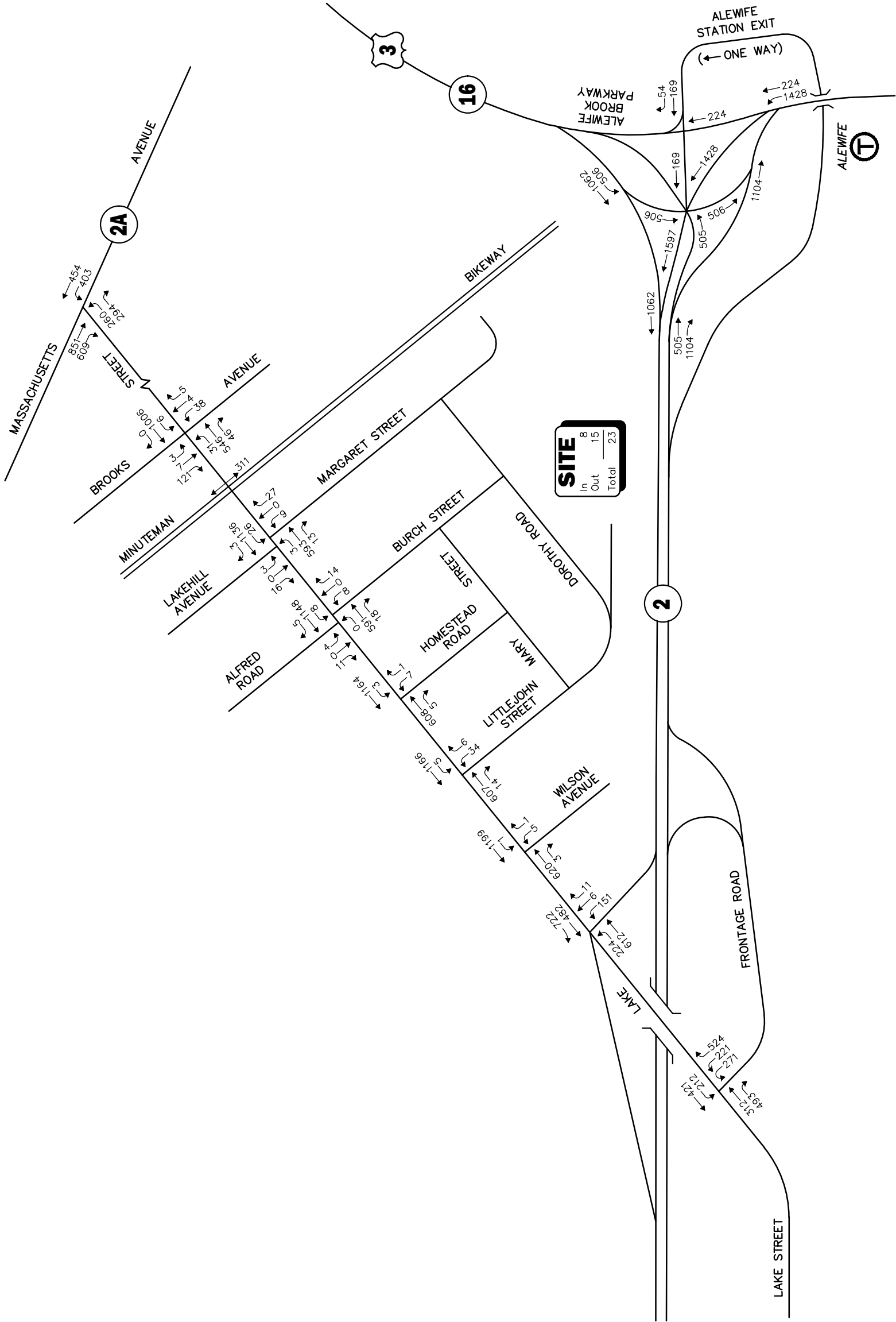
Based on the ITE data comparison, the Project is expected to generate less vehicle trips than the previously proposed development. The 2027 Build weekday morning and evening peak-hour traffic volumes are graphically depicted on Figure 10RR and 11RR.

ANALYSIS RESULTS

An updated level-of-service analysis was conducted for 2027 Build conditions using the ITE data for the currently proposed program. Table 6 and Table 7 provide a summary of the updated analysis as well as a comparison to the previous programs 2027 No-Build and 2027 Build conditions level of service for unsignalized and signalized study area intersections, respectively.

Unsignalized Intersection Analysis Results

As shown in Table 6, the updated level-of-service analysis indicates that traffic operations did not change significantly compared to the No Build condition with no change in critical movement level of service over 2027 No-Build conditions or the previously proposed Build program.



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

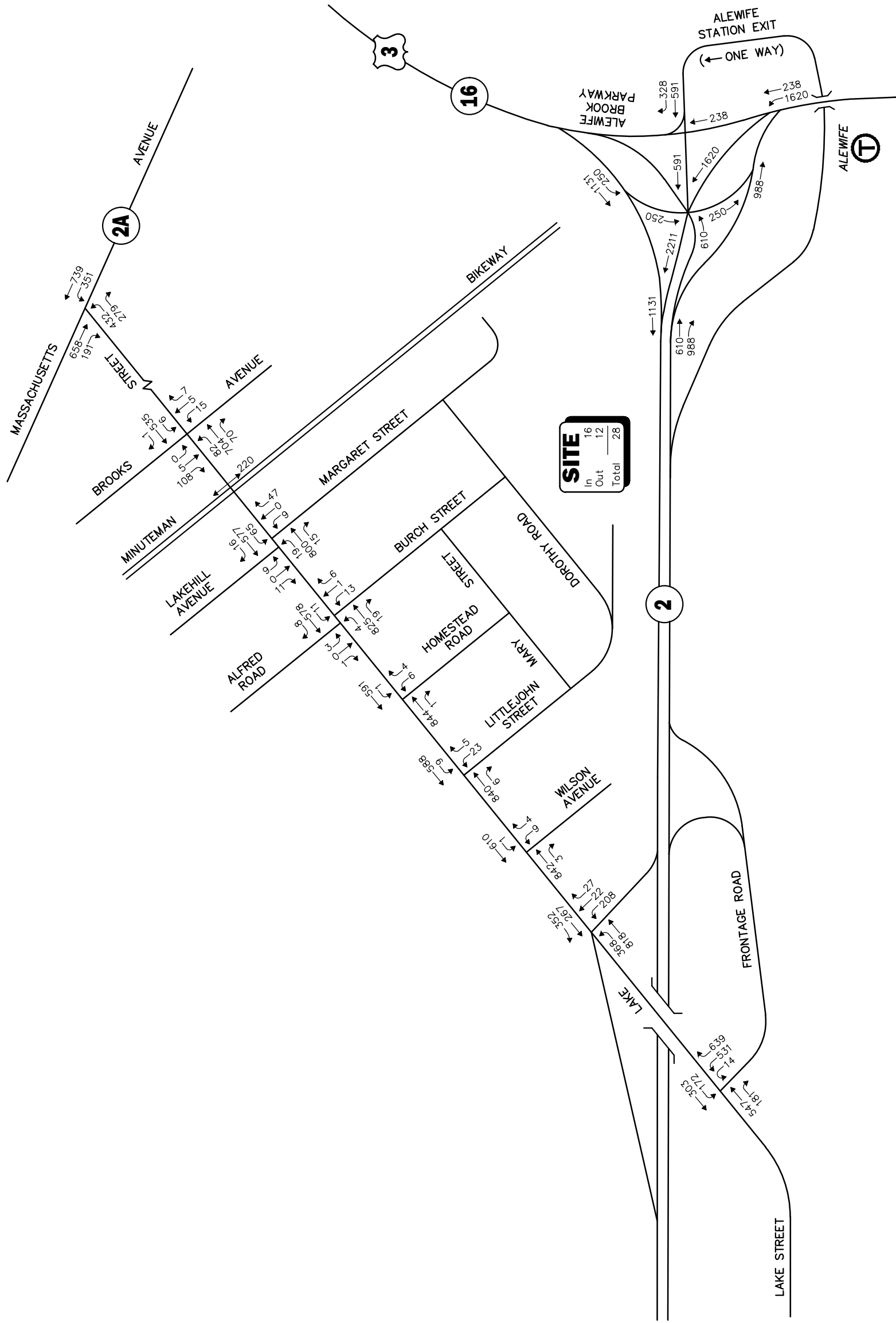
Not To Scale



VAI Vanasse & Associates inc

Figure 10RR

2027 Build
Weekday Morning
Peak Hour Traffic Volumes



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale



Vanasse & Associates inc

Figure 11RR

2027 Build Weekday Evening Peak Hour Traffic Volumes

Table 6
UNSIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Unsignalized Intersection/ Critical Movement/Peak Hour	2027 No-Build: Previous Program				2027 Build: Previous Program				2027 Build: Current Program			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d (feet)	V/C	Delay	LOS	Queue (feet)	V/C	Delay	LOS	Queue (feet)
Lake Street at Wilson Avenue												
<i>Weekday Morning:</i>												
Wilson Avenue NB LT/RT	0.13	>50	F	10	0.14	>50	F	13	0.14	>50	F	13
<i>Weekday Evening:</i>												
Wilson Avenue NB LT/RT	0.15	40	E	13	0.15	42	E	13	0.15	42	E	13
Lake Street at Littlejohn Street												
<i>Weekday Morning:</i>												
Littlejohn Street NB LT/RT	0.56	>50	F	60	0.87	>50	F	103	0.81	>50	F	95
<i>Weekday Evening:</i>												
Littlejohn Street NB LT/RT	0.20	39	E	18	0.31	48	E	30	0.31	47	E	30
Lake Street at Homestead Road												
<i>Weekday Morning:</i>												
Homestead Road NB LT/RT	0.16	>50	F	13	0.29	>50	F	23	0.16	>50	F	13
<i>Weekday Evening:</i>												
Homestead Road NB LT/RT	0.09	31	D	8	0.09	31	D	8	0.09	31	D	8
Lake Street at Burch Street/Alfred Road												
<i>Weekday Morning:</i>												
Burch Street NB LT/TH/RT	0.27	>50	F	25	0.27	>50	F	25	0.27	>50	F	25
Alfred Road SB LT/TH/RT	0.15	44	E	13	0.15	45	E	13	0.15	45	E	13
<i>Weekday Evening:</i>												
Burch Street NB LT/TH/RT	0.28	>50	F	25	0.28	>50	F	25	0.28	>50	F	25
Alfred Road SB LT/TH/RT	0.06	48	E	5	0.06	48	E	5	0.06	48	E	5

See notes at end of table.

Table 6 (Continued)
UNSIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Unsignalized Intersection/ Critical Movement/Peak Hour	2027 No-Build: Previous Program				2027 Build: Previous Program				2027 Build: Current Program			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d (feet)	V/C	Delay	LOS	Queue (feet)	V/C	Delay	LOS	Queue (feet)
Lake Street at Margaret Street/Lakehill Avenue												
<i>Weekday Morning:</i>												
Margaret Street NB LT/TH/RT	0.80	>50	F	83	0.89	>50	F	100	0.87	>50	F	95
Lakehill Avenue SB LT/TH/RT	0.20	40	E	18	0.20	41	E	18	0.20	41	E	18
<i>Weekday Evening:</i>												
Margaret Street NB LT/TH/RT	0.90	>50	F	113	0.98	>50	F	125	0.96	>50	F	123
Lakehill Avenue SB LT/TH/RT	0.40	>50	F	38	0.48	>50	F	45	0.46	>50	F	43
Littlejohn Streets/Dorothy Street at Site Driveway												
<i>Weekday Morning:</i>												
Site Driveway NB TH/RT	Intersection constructed under 2027 Build conditions				0.03	9	A	2	0.02	9	A	1
<i>Weekday Evening:</i>												
Site Driveway NB TH/RT					0.02	9	A	1	0.01	9	A	1

^aVolume-to-capacity ratio.

^bDelay in seconds per vehicle.

^cLevel of service.

^d95th percentile queue length in feet.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Signalized Intersection Analysis Results

As shown in Table 7, the updated level-of-service analysis indicates that traffic operations did not change significantly compared to the No Build condition with no change in overall intersection level of service over 2027 No-Build conditions or the previously proposed Build program.

Table 7
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Location/Peak Hour/Movement	2027 No-Build: Previous Program				2027 Build: Previous Program				2027 Build: Current Program			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th
ROUTE 2 AT ROUTE 16 (4 SIGNALS)												
Signal 1: Route 2 WB at Route 16 SB:												
<i>Weekday Morning:</i>												
Route 2 WB TH	0.85	10	B	43/40	0.85	10	B	43/40	0.85	10	B	43/40
Route 16 SB RT	1.02	63	F	581/659	1.02	63	F	581/659	1.02	63	F	581/659
Overall	--	32	C	--	--	32	C	--	--	32	C	--
<i>Weekday Evening:</i>												
Route 2 WB TH	1.08	48	F	702/57	1.08	49	F	704/56	1.08	49	F	704/56
Route 16 SB RT	0.95	47	D	472/644	0.95	47	D	472/644	0.95	47	D	472/644
Overall	--	48	D	--	--	48	D	--	--	48	D	--
Signal 2: Route 2 EB at Route 16 NB/SB/ Alewife Station Access Road:												
<i>Weekday Morning:</i>												
Route 2 EB LT	0.92	72	E	206/308	0.92	72	E	206/308	0.92	72	E	206/308
Alewife Station Access Road WB TH	0.26	17	B	86/138	0.26	17	B	86/138	0.26	17	B	86/138
Route 16 NB LT	1.09	>80	F	728/868	1.09	>80	F	730/868	1.09	>80	F	730/868
Route 16 SB TH	0.72	47	D	223/269	0.72	47	D	223/269	0.72	47	D	223/269
Overall	--	73	E	--	--	73	E	--	--	73	E	--
<i>Weekday Evening:</i>												
Route 2 EB LT	1.19	>80	F	326/446	1.19	>80	F	326/446	1.19	>80	F	326/446
Alewife Station Access Road WB TH	0.85	33	C	422/639	0.85	33	C	422/639	0.85	33	C	422/639
Route 16 NB LT	1.14	>80	F	792/931	1.14	>80	F	794/933	1.14	>80	F	794/933
Route 16 SB TH	0.31	38	D	84/123	0.31	38	D	84/123	0.31	38	D	84/123
Overall	--	>80	F	--	--	>80	F	--	--	>80	F	--
Signal 3: Route 16 NB/SB at Alewife Station Access Road:												
<i>Weekday Morning:</i>												
Alewife Station Access Road WB TH	0.17	9	A	50/81	0.17	9	A	50/81	0.17	9	A	50/81
Alewife Station Access Road WB RT	0.07	8	A	15/31	0.07	8	A	15/31	0.07	8	A	15/31
Route 16 NB TH	0.32	38	D	83/121	0.32	38	D	83/121	0.32	38	D	83/121
Overall	--	23	C	--	--	23	C	--	--	23	C	--
<i>Weekday Evening:</i>												
Alewife Station Access Road WB TH	0.56	16	B	239/337	0.56	16	B	239/337	0.56	16	B	239/337
Alewife Station Access Road WB RT	0.36	11	B	110/165	0.36	11	B	110/165	0.36	11	B	110/165
Route 16 NB TH	0.30	38	D	81/119	0.30	38	D	81/119	0.30	38	D	81/119
Overall	--	19	B	--	--	19	B	--	--	19	B	--

See notes at end of table.



Table 7 (Continued)
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Location/Peak Hour/Movement	2027 No-Build: Previous Program				2027 Build: Previous Program				2027 Build: Current Program			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th
Signal 4: Route 2 EB at Route 16 SB:												
<i>Weekday Morning:</i>												
Route 2 EB RT	0.52	12	B	220/272	0.52	12	B	221/272	0.52	12	B	221/272
Route 16 SB TH	0.62	4	A	5/0	0.62	4	A	5/0	0.62	4	A	5/0
Overall	--	9	A	--	--	9	A	--	--	9	A	--
<i>Weekday Evening:</i>												
Route 2 EB RT	0.50	11	B	209/255	0.50	11	B	210/258	0.50	11	B	210/258
Route 16 SB TH	0.26	1	A	0/1	0.26	1	A	0/1	0.26	1	A	0/1
Overall	--	10	A	--	--	10	A	--	--	10	A	--
LAKE STREET AT ROUTE 2 EB ON/OFF-RAMPS:												
<i>Weekday Morning:</i>												
Lake Street EB TH	0.64	28	C	118/204	0.65	28	C	119/205	0.65	28	C	119/205
Lake Street EB RT	0.30	0	A	0/0	0.30	0	A	0/0	0.30	0	A	0/0
Lake Street WB LT	0.58	27	C	83/151	0.58	27	C	84/152	0.58	27	C	84/152
Lake Street WB TH	0.25	7	A	42/57	0.25	6	A	43/57	0.25	7	A	43/57
Route 2 EB Off-Ramp NB LT	1.04	79	F	234/482	1.04	>80	F	236/482	1.04	80	F	236/482
Route 2 EB Off-Ramp NB RT	0.78	17	B	54/243	0.78	17	B	55/246	0.78	17	B	55/247
Overall	--	26	C	--	--	27	C	--	--	27	C	--
<i>Weekday Evening:</i>												
Lake Street EB TH	0.75	27	C	215/361	0.75	27	C	216/362	0.75	27	C	216/362
Lake Street EB RT	0.12	0	A	0/0	0.12	0	A	0/0	0.12	0	A	0/0
Lake Street WB LT	0.61	36	D	79/156	0.61	36	D	80/157	0.61	36	D	80/157
Lake Street WB TH	0.16	5	A	28/40	0.16	5	A	28/40	0.16	5	A	28/40
Route 2 EB Off-Ramp NB LT	>1.20	>80	F	315/634	>1.20	>80	F	316/635	>1.20	>80	F	316/635
Route 2 EB Off-Ramp NB RT	0.90	28	C	90/361	0.90	29	C	93/368	0.90	29	C	92/367
Overall	--	49	D	--	--	50	D	--	--	50	D	--

See notes at end of table.



Table 7 (Continued)
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Location/Peak Hour/Movement	2027 No-Build: Previous Program				2027 Build: Previous Program				2027 Build: Current Program			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th
LAKE STREET AT ROUTE 2 WB ON/OFF-RAMPS:												
<i>Weekday Morning:</i>												
Lake Street EB LT	0.77	41	D	88/179	0.77	41	D	88/179	0.77	41	D	88/179
Lake Street EB TH	0.69	15	B	167/265	0.70	15	B	168/268	0.70	15	B	169/268
Lake Street WB TH	1.05	>80	F	214/378	1.06	>80	F	217/381	1.06	>80	F	217/381
Lake Street WB RT	1.03	51	F	135/357	1.04	55	F	169/364	1.03	54	F	167/363
Route 2 WB Off-Ramp NB LT	0.23	19	B	28/56	0.23	19	B	28/56	0.23	19	B	28/56
Route 2 WB Off-Ramp NB LT/TH	0.22	19	B	28/55	0.22	19	B	28/55	0.22	19	B	28/55
Route 2 WB Off-Ramp NB RT	0.02	0	A	0/0	0.02	0	A	0/0	0.02	0	A	0/0
Overall	--	44	D	--	--	45	D	--	--	45	D	--
<i>Weekday Evening:</i>												
Lake Street EB LT	1.18	>80	F	191/331	1.19	>80	F	191/331	1.19	>80	F	191/331
Lake Street EB TH	0.94	32	C	275/503	0.94	34	C	283/514	0.94	34	C	281/513
Lake Street WB TH	0.65	27	C	92/162	0.64	27	C	93/163	0.65	27	C	93/163
Lake Street WB RT	0.59	7	A	0/56	0.59	7	A	0/57	0.59	7	A	0/57
Route 2 WB Off-Ramp NB LT	0.27	19	B	35/75	0.27	19	B	35/75	0.27	19	B	35/75
Route 2 WB Off-Ramp NB LT/TH	0.26	19	B	36/76	0.26	19	B	36/76	0.26	19	B	36/76
Route 2 WB Off-Ramp NB RT	0.04	0	A	0/0	0.05	0	A	0/0	0.05	0	A	0/0
Overall	--	45	D	--	--	45	D	--	--	45	D	--
LAKE STREET AT MINUTEMAN COMMUTER BIKEWAY:												
<i>Weekday Morning:</i>												
Lake Street EB TH	0.53	60	E	132/180	0.54	61	E	134/182	0.53	61	E	133/181
Lake Street WB TH	0.82	68	E	569/580	0.82	68	E	570/580	0.82	68	E	570/580
Overall	--	65	E	--	--	65	E	--	--	65	E	--
<i>Weekday Evening:</i>												
Lake Street EB TH	0.73	62	E	230/312	0.73	62	E	233/316	0.73	62	E	233/316
Lake Street WB TH	0.46	9	A	226/307	0.47	9	A	31/45	0.46	9	A	229/167
Overall	--	41	D	--	--	41	D	--	--	41	D	--

See notes at end of table.



Table 7 (Continued)
SIGNALIZED INTERSECTION CAPACITY ANALYSIS SUMMARY

Location/Peak Hour/Movement	2027 No-Build: Previous Program				2027 Build: Previous Program				2027 Build: Current Program			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th	V/C	Delay	LOS	Queue 50 th /95 th
LAKE STREET AT BROOKS AVENUE:												
<i>Weekday Morning:</i>												
Lake Street EB LT/TH/RT	0.64	53	D	246/442	0.64	57	E	249/448	0.64	56	E	248/448
Lake Street WB LT/TH/RT	1.03	>80	F	635/877	1.03	>80	F	636/879	1.03	>80	F	636/879
Brooks Avenue NB LT/TH/RT	0.50	38	D	23/44	0.50	38	D	23/44	0.50	38	D	23/44
Brooks Avenue SB LT/TH/RT	0.48	11	B	5/35	0.48	11	B	5/35	0.48	11	B	5/35
Overall	--	68	E	--	--	69	E	--	--	69	E	--
<i>Weekday Evening:</i>												
Lake Street EB LT/TH/RT	0.87	74	E	274/672	0.88	75	E	281/678	0.88	75	E	279/677
Lake Street WB LT/TH/RT	0.51	13	B	171/284	0.52	13	B	174/289	0.51	13	B	174/288
Brooks Avenue NB LT/TH/RT	0.29	29	C	11/29	0.29	29	C	11/29	0.29	29	C	11/29
Brooks Avenue SB LT/TH/RT	0.50	13	B	2/33	0.50	13	B	2/33	0.50	13	B	2/33
Overall	--	47	D	--	--	47	D	--	--	47	D	--
MASSACHUSETTS AVENUE AT LAKE STREET:												
<i>Weekday Morning:</i>												
Lake Street EB LT	0.73	47	D	167/257	0.73	47	D	170/259	0.73	47	D	169/258
Lake Street EB RT	0.59	14	B	40/122	0.59	14	B	42/125	0.59	14	B	41/125
Massachusetts Avenue NB LT	>1.20	>80	F	336/550	>1.20	>80	F	339/554	>1.20	>80	F	339/554
Massachusetts Avenue NB TH	0.50	19	B	213/332	0.50	19	B	214/332	0.50	19	B	214/332
Massachusetts Avenue SB TH	0.76	33	C	281/409	0.76	33	C	282/409	0.76	33	C	282/409
Massachusetts Avenue SB RT	0.99	55	E	362/604	0.99	56	E	364/606	0.99	56	E	364/606
Overall	--	66	E	--	--	67	E	--	--	67	E	--
<i>Weekday Evening:</i>												
Lake Street EB LT	1.01	>80	F	359/537	1.01	>80	F	362/541	1.01	>80	F	362/541
Lake Street EB RT	0.58	23	C	100/185	0.59	24	C	102/188	0.58	24	C	102/187
Massachusetts Avenue NB LT	1.13	>80	F	217/422	1.14	>80	F	224/433	1.14	>80	F	223/431
Massachusetts Avenue NB TH	0.87	35	C	480/740	0.87	35	C	480/740	0.87	35	C	480/740
Massachusetts Avenue SB TH	0.62	30	C	211/277	0.62	30	C	211/277	0.62	30	C	211/277
Massachusetts Avenue SB RT	0.37	17	B	58/122	0.37	17	B	59/124	0.37	17	B	59/124
Overall	--	49	D	--	--	50	D	--	--	50	D	--

^aVolume to capacity ratio.

^bAverage stopped delay per vehicle (in seconds).

^cLevel of service.

^dQueue length in feet.



ITE PARKING DEMAND CALCULATIONS

Parking demand calculations for the proposed 124 units of senior housing were conducted utilizing parking ratio data for ITE LUC 252, *Senior Housing – Attached*. The parking demand data was obtained from the ITE *Parking Generation Manual 5th Edition*². Table 8 summarizes the parking demand calculations.

Table 8
PARKING DEMAND CALCULATIONS

ITE LUC	Number of Units	Average Parking Demand Rate	Required Spaces	Provided Spaces	Surplus Spaces
252	124	0.61 spaces/unit	76	96	20

As shown in Table 8, ITE data indicates that the average parking demand rate for senior housing facilities is 0.61 spaces per unit. The proposed development will construct 124 units and therefore requires 76 parking spaces for the development. The development as proposed will construct 96 parking spaces, which leaves 20 surplus spaces above the ITE methodology.

TRUCK TURNING DIAGRAMS: EMERGENCY RESPONSE VEHICLES

As requested, AutoTURN analyses were conducted for an ambulance and fire truck entering and exiting the site via Littlejohn Street. The specifications of the fire truck were obtained from the Arlington Fire Department. To provide a more conservative review, the analysis was conducted assuming cars are parked on both sides of Littlejohn Street, both in a staggered formation and directly across from each other. The analysis shows the emergency vehicles can travel to the site on Littlejohn Street with cars parked along both sides of the street. Figure 1 shows the ambulance entering the site, Figure 2 shows the ambulance exiting the site, Figure 3 shows the fire truck entering the site, and Figure 4 shows the fire truck exiting the site. The fastest route for an emergency response is via Massachusetts Avenue for fire trucks (from the 411 Massachusetts Avenue station) and Concord Turnpike (Route 2) for ambulances.

CONCLUSIONS

The current development program of 12 townhouses and 124 senior independent living residences is expected to result in 4 less vehicle trips during the weekday morning peak hour and 5 less trips during the weekday evening peak hour when compared to the previously proposed development program. The updated analyses indicate that a decrease in 4 to 5 peak-hour trips did not have a significant impact. Minor changes in delays and queue lengths were recorded but no change in level of service to critical movements or to overall intersection ratings of the No Build condition occurred as a result of the 4 to 5 fewer peak-hour trips.

The ITE parking demand calculations show the proposed 124 units of senior housing would require 76 parking spaces. The development plans to construct 96 parking spaces, which leaves an additional 20 spaces above the ITE methodology.

² *Parking Generation Manual 5th Edition*; Institute of Transportation Engineers; January 2019.

Arlington Ambulance

25.00

15.00

4.00

Width

: 8.00

feet

Track

: 8.00

Lock to Lock Time

: 6.0

Steering Angle

: 33.8

Source: Google Earth.

0 25 50 Scale in Feet

Figure 1

Ambulance Enter Site via
Littlejohn Street

Vanasse &
Associates inc

Copyright © 2021 by VAI. All Rights Reserved.

Arlington Ambulance

25.00

4.00

15.00

Width

: 8.00

feet

Track

: 8.00

Lock to Lock Time

: 6.0

Steering Angle

: 33.8

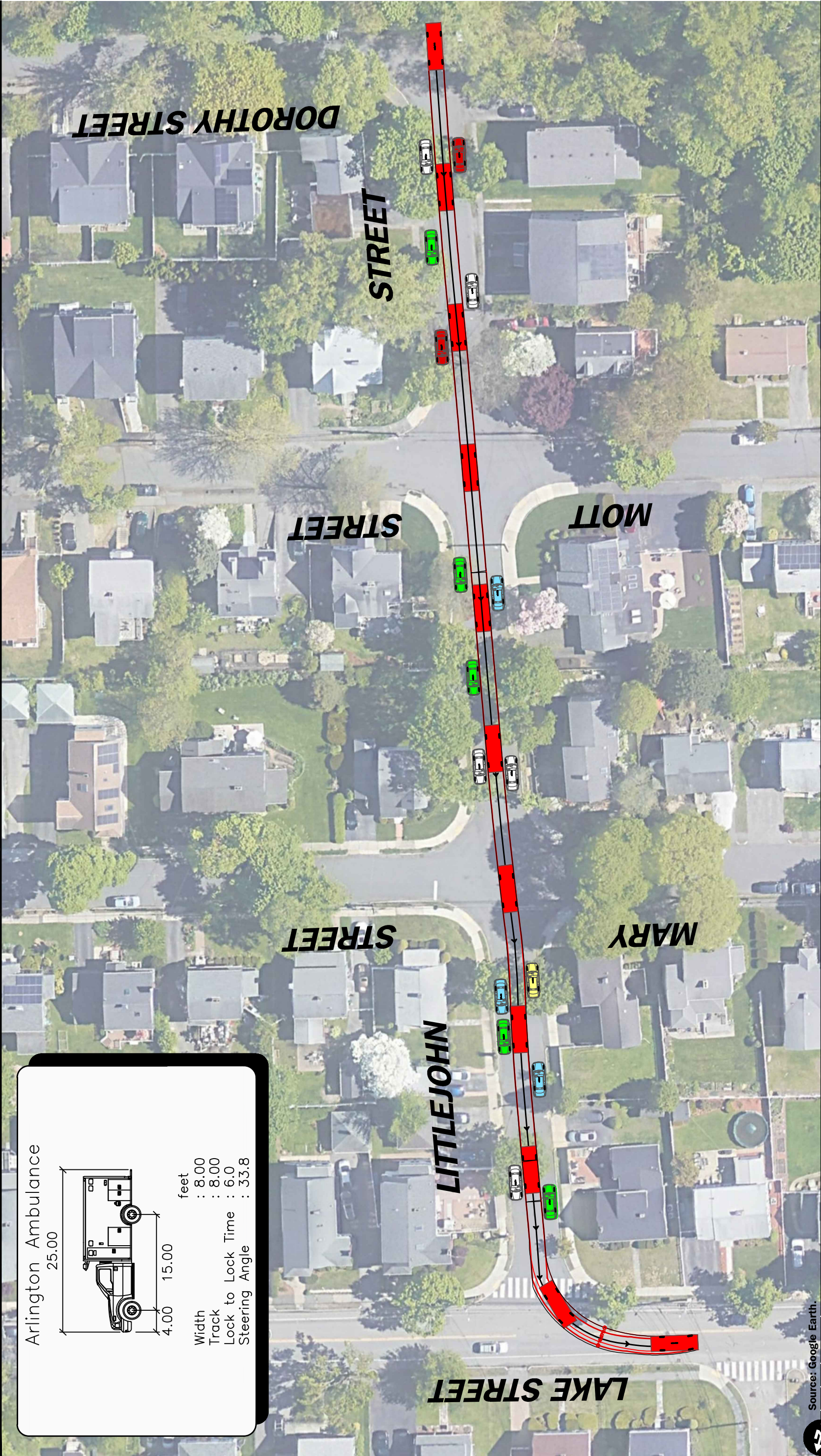
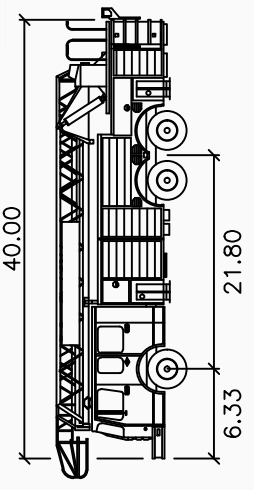


Figure 2

Ambulance Exiting Site via
Littlejohn Street

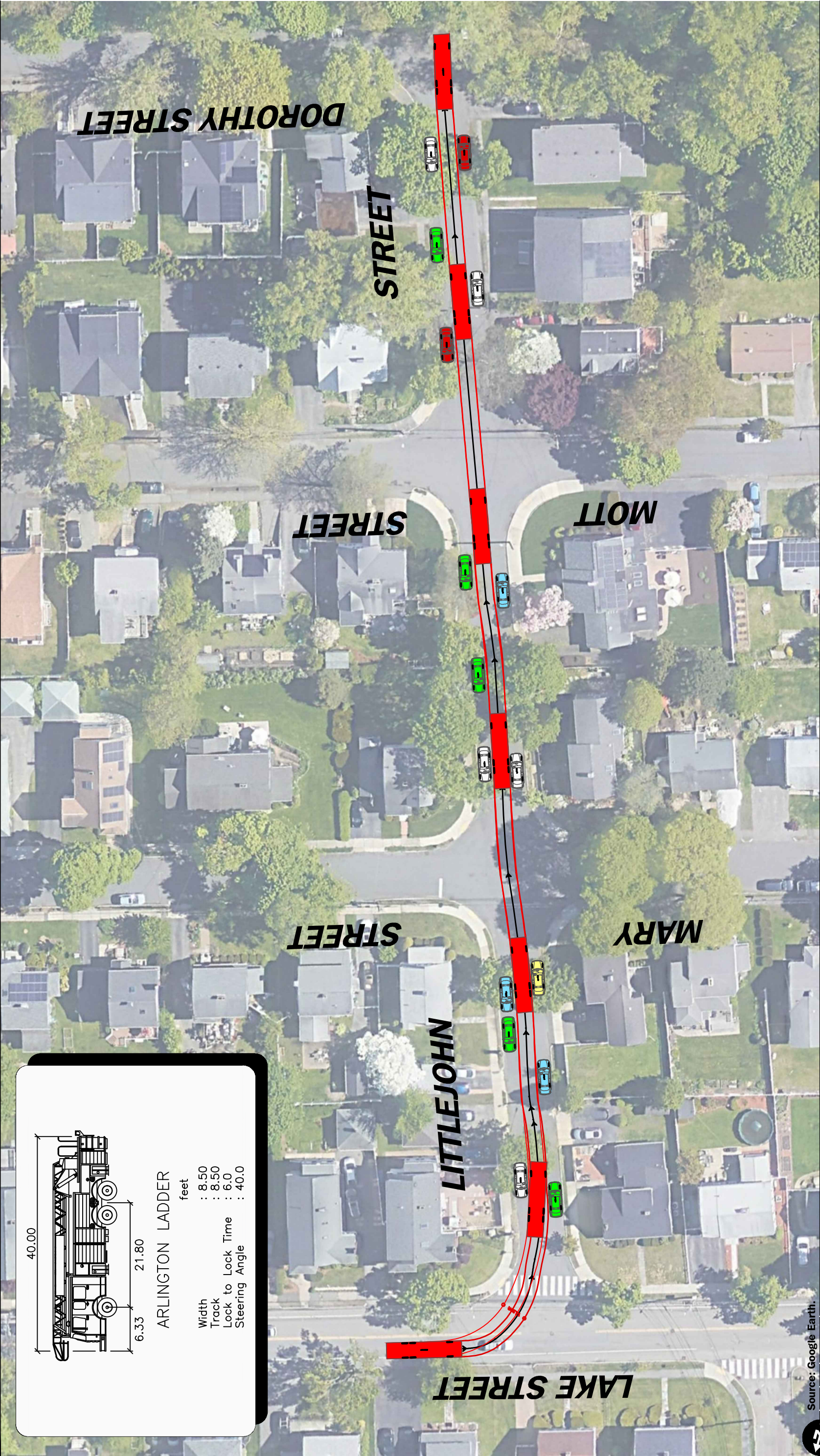


40.00
6.33
21.80

ARLINGTON LADDER

feet

Width	: 8.50
Track	: 8.50
Lock to Lock Time	: 6.0
Steering Angle	: 40.0

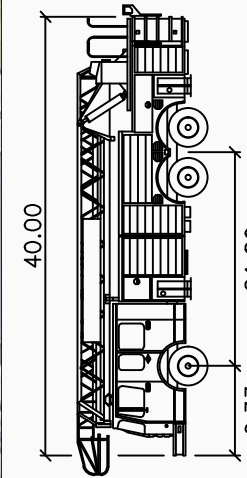


Source: Google Earth.

0 25 50 Scale in Feet

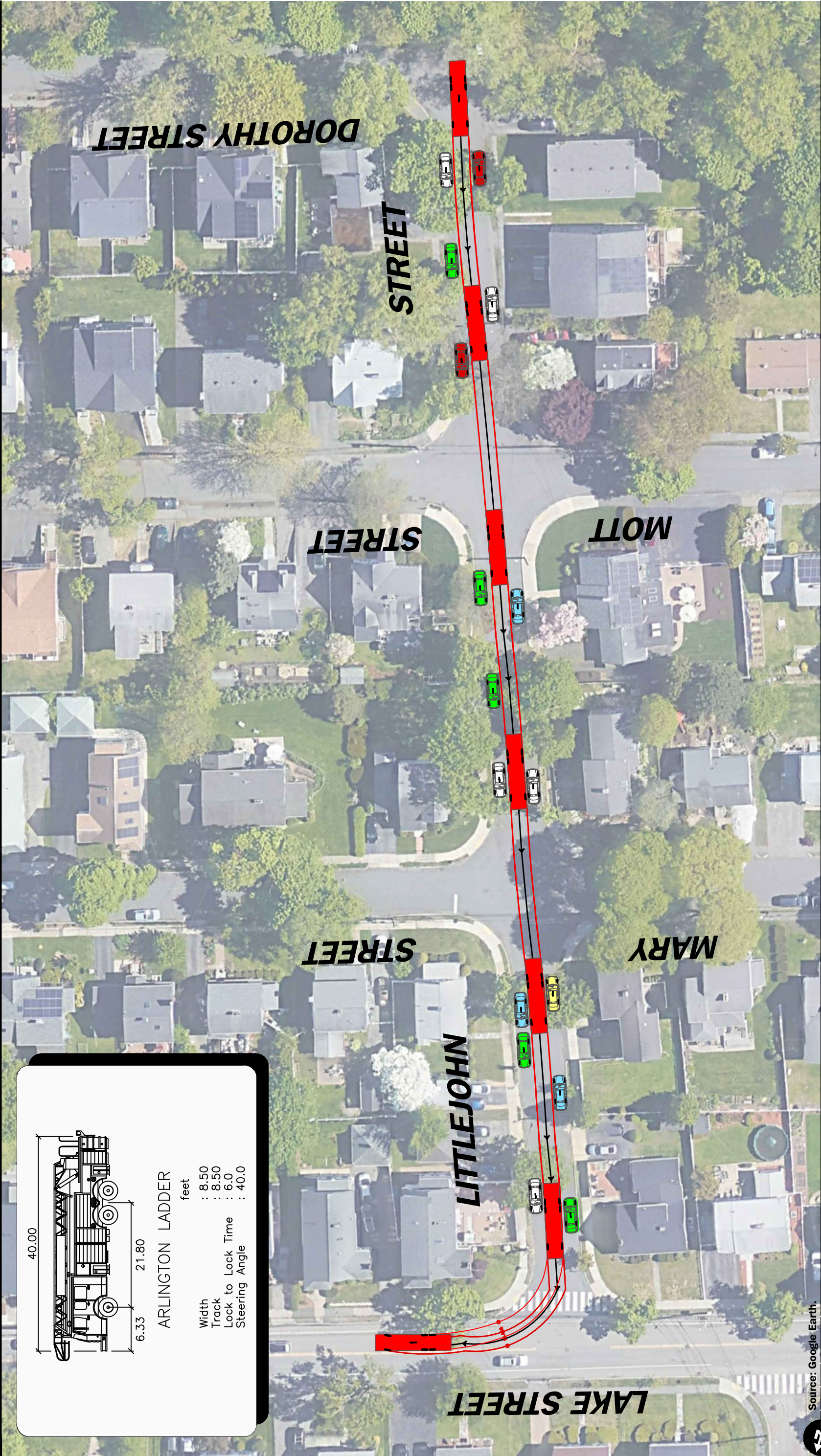
Figure 3

Arlington Fire Ladder Truck
Entering Site via Littlejohn Street



ARLINGTON LADDER

Width	feet
Track	: 8.50
Lock to Lock Time	: 8.50
Steering Angle	: 6.0
	: 40.0



Source: Google Earth.

0 25 50 Scale in Feet

Figure 4

Lastly, the emergency response vehicle truck turning diagrams showed that both ambulances and the Town specified fire truck can access the site via Littlejohn Street, even with cars parked on both sides of the street.

Based on the above, the project will not have a substantial impact on traffic operation throughout the study area and therefore can be safely accommodated with the implementation of the recommendations identified in the peer review process.

If you have any questions on the information or conclusions reached herein, feel free to contact me.

Sincerely,

VANASSE & ASSOCIATES, INC.

A handwritten signature in blue ink, appearing to read "Scott W. Thornton".

Scott W. Thornton, P.E.
Principal

A handwritten signature in blue ink, appearing to read "Derek I. Roach".

Derek I. Roach, P.E.
Senior Transportation Engineer

Attachments: Technical Appendix

cc: File

APPENDIX

CENSUS DATA
TRIP GENERATION CALCULATIONS
CAPACITY ANALYSIS

CENSUS DATA

COMMUTING CHARACTERISTICS BY SEX

Note: This is a modified view of the original table produced by the U.S. Census Bureau. This download or printed version may have missing information from the original table.

Census Tract 3561, Middlesex County, Massachusetts				
		Total		Male
Label	Estimate	Margin of Error	Estimate	
▼ Workers 16 years and over	2,051	±155	1,048	
▼ MEANS OF TRANSPORTATION TO WORK				
▼ Car, truck, or van	54.5%	±7.2	57.7%	
Drove alone	42.9%	±7.6	45.8%	
▼ Carpooled	11.6%	±4.5	11.9%	
In 2-person carpool	9.6%	±4.2	9.9%	
In 3-person carpool	1.5%	±1.8	1.0%	
In 4-or-more person carpool	0.5%	±0.8	1.0%	
Workers per car, truck, or van	1.13	±0.06	1.13	
Public transportation (excluding taxicab)	31.6%	±6.4	29.4%	
Walked	0.0%	±1.7	0.0%	
Bicycle	6.1%	±2.8	7.8%	
Taxicab, motorcycle, or other means	1.3%	±2.0	0.0%	
Worked at home	6.5%	±3.6	5.1%	
▼ PLACE OF WORK				
▼ Worked in state of residence	98.1%	±1.5	97.9%	
Worked in county of residence	65.1%	±6.2	61.6%	
Worked outside county of residence	33.0%	±6.3	36.3%	
Worked outside state of residence	1.9%	±1.5	2.1%	
▼ Living in a place	100.0%	±1.7	100.0%	
Worked in place of residence	11.2%	±4.0	7.6%	
Worked outside place of residence	88.8%	±4.0	92.4%	
Not living in a place	0.0%	±1.7	0.0%	
▼ Living in 12 selected states	100.0%	±1.7	100.0%	
Worked in minor civil division of residence	11.2%	±4.0	7.6%	
Worked outside minor civil division of residence	88.8%	±4.0	92.4%	
Not living in 12 selected states	0.0%	±1.7	0.0%	
▼ Workers 16 years and over who did not work at home	1,918	±178	995	
▼ TIME LEAVING HOME TO GO TO WORK				
12:00 a.m. to 4:59 a.m.	0.9%	±1.4	0.0%	
5:00 a.m. to 5:29 a.m.	0.4%	±0.7	0.0%	
5:30 a.m. to 5:59 a.m.	3.2%	±2.2	1.7%	
6:00 a.m. to 6:29 a.m.	2.1%	±1.9	2.8%	
6:30 a.m. to 6:59 a.m.	10.5%	±4.2	11.5%	
7:00 a.m. to 7:29 a.m.	17.8%	±5.9	21.6%	
7:30 a.m. to 7:59 a.m.	21.8%	±6.0	22.6%	
8:00 a.m. to 8:29 a.m.	16.1%	±5.0	13.8%	

Table Notes

COMMUTING CHARACTERISTICS BY SEX

Survey/Program:
American Community Survey
Year:
2018
Estimates:
5-Year
Table ID:
S0801

Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities, and towns and estimates of housing units for states and counties.

Source: U.S. Census Bureau, 2014-2018 American Community Survey 5-Year Estimates

When information is missing or inconsistent, the Census Bureau logically assigns an acceptable value using the response to a related question or questions. If a logical assignment is not possible, data are filled using a statistical process called allocation, which uses a similar individual or household to provide a donor value. The "Allocated" section is the number of respondents who received an allocated value for a particular subject.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see ACS Technical Documentation). The effect of nonsampling error is not represented in these tables.

The 12 selected states are Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin.

Workers include members of the Armed Forces and civilians who were at work last week.

While the 2014-2018 American Community Survey (ACS) data generally reflect the February 2013 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities.

Estimates of urban and rural populations, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2010 data. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

Explanation of Symbols:

- An "***" entry in the margin of error column indicates that either no sample observations or too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
- An "-" entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution, or the margin of error associated with a median was larger than the median itself.
- An "-" following a median estimate means the median falls in the lowest interval of an open-ended distribution.
- An "+" following a median estimate means the median falls in the upper interval of an open-ended distribution.
- An "***" entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
- An "*****" entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
- An "N" entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
- An "(X)" means that the estimate is not applicable or not available.

Supporting documentation on code lists, subject definitions, data accuracy, and statistical testing can be found on the American Community Survey website in the Technical Documentation section.

Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.

TRIP GENERATION CALCULATIONS

Institute of Transportation Engineers (ITE)
Trip Generation, 10th Edition
Land Use Code (LUC) 220 - Multifamily Housing (Low-Rise)

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 12

AVERAGE WEEKDAY DAILY

$$T = 7.32 * (X)$$

$$T = 7.32 * 12$$

$$T = 87.84$$

$$T = 88.00$$

$$T = 88 \text{ vehicle trips}$$

with 50% (44 vpd) entering and 50% (44 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 0.46 * (X)$$

$$T = 0.46 * 12$$

$$T = 5.52$$

$$T = 6 \text{ vehicle trips}$$

with 23% (1 vph) entering and 77% (5 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 0.56 * (X)$$

$$T = 0.56 * 12$$

$$T = 6.72$$

$$T = 7.00$$

$$T = 7 \text{ vehicle trips}$$

with 63% (4 vph) entering and 37% (3 vph) exiting.

AVERAGE SATURDAY

$$T = 8.14 * (X)$$

$$T = 8.14 * 12$$

$$T = 97.68$$

$$T = 98.00$$

$$T = 98 \text{ vehicle trips}$$

with 50% (49 vpd) entering and 50% (49 vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$$T = 0.70 * (X)$$

$$T = 0.70 * 12$$

$$T = 8.40$$

$$T = 8 \text{ vehicle trips}$$

with 54% (4 vph) entering and 46% (4 vph) exiting.

Institute of Transportation Engineers (ITE)
Trip Generation, 10th Edition
Land Use Code (LUC) 252 - Senior Adult Housing - Attached

Average Vehicle Trips Ends vs: Dwelling Units
 Independent Variable (X): 124

AVERAGE WEEKDAY DAILY

$T = 4.02 * (X) - 25.37$
 $T = 4.02 * 124 - 25.37$
 $T = 473.11$
 $T = 474$ vehicle trips
 with 50% (237 vph) entering and 50% (237 vph) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$T = 0.20 * (X) - 0.18$
 $T = 0.20 * 124 - 0.18$
 $T = 24.62$
 $T = 25$ vehicle trips
 with 35% (9 vph) entering and 65% (16 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$T = 0.24 * (X) + 2.26$
 $T = 0.24 * 124 + 2.26$
 $T = 32.02$
 $T = 32$ vehicle trips
 with 55% (18 vph) entering and 45% (14 vph) exiting.

SATURDAY DAILY

$T = 3.97 * (X) - 60.09$
 $T = 3.97 * 124 - 60.09$
 $T = 432.19$
 $T = 432$ vehicle trips
 with 50% (216 vph) entering and 50% (216 vph) exiting.

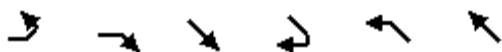
SATURDAY MIDDAY PEAK HOUR OF GENERATOR

$T = 0.35 * (X) - 1.67$
 $T = 0.35 * 124 - 1.67$
 $T = 41.73$
 $T = 42$ vehicle trips
 with 62% (26 vph) entering and 38% (16 vph) exiting.

CAPACITY ANALYSIS

2027 No-Build Weekday Morning Peak Hour Previous Program
2027 No-Build Weekday Evening Peak Hour Previous Program
2027 Build Weekday Morning Peak Hour Previous Program
2027 Build Weekday Evening Peak Hour Previous Program
2027 Build Weekday Morning Peak Hour Current Program
2027 Build Weekday Evening Peak Hour Current Program

2027 No-Build Weekday Morning Peak Hour Previous Program



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	258	291	851	608	402	454	
Future Volume (vph)	258	291	851	608	402	454	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2025	1812	3421	1492	1728	1863	
Flt Permitted	0.950				0.143		
Satd. Flow (perm)	2025	1812	3421	1492	260	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		244		211			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	1%	1%	2%	1%	1%	2%	
Adj. Flow (vph)	284	320	925	661	437	493	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	284	320	925	661	437	493	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effect Green (s)	17.1	17.1	31.8	31.8	48.2	47.2	
Actuated g/C Ratio	0.19	0.19	0.36	0.36	0.54	0.53	
v/c Ratio	0.73	0.59	0.76	0.99	1.49	0.50	
Control Delay	46.5	14.1	32.7	55.2	258.1	18.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	46.5	14.1	32.7	55.2	258.1	18.7	
LOS	D	B	C	E	F	B	
Approach Delay	29.3		42.1			131.2	
Approach LOS	C		D			F	

Intersection Summary

Area Type: Other

Cycle Length: 105

Actuated Cycle Length: 88.8

Natural Cycle: 120

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.49

Intersection Signal Delay: 66.2

Intersection LOS: E

Intersection Capacity Utilization 76.8%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 2: Massachusetts Avenue/Massachusetts Avenue & Lake Street

53 s	29 s	23 s
15 s	38 s	



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	284	320	925	661	437	493
v/c Ratio	0.73	0.59	0.76	0.99	1.49	0.50
Control Delay	46.5	14.1	32.7	55.2	258.1	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.5	14.1	32.7	55.2	258.1	18.7
Queue Length 50th (ft)	167	40	281	~362	~336	213
Queue Length 95th (ft)	257	122	#409	#604	#550	332
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	515	642	1225	670	293	990
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.50	0.76	0.99	1.49	0.50

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.














95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 No-Build Weekday Morning Peak Hour

01/14/2021

							
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	311	493	210	419	271	221	520
Future Volume (vph)	311	493	210	419	271	221	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2132	1812	1685	3455	0	2037	1706
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2132	1812	1685	3455	0	2037	1706
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		333					402
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Peak Hour Factor	0.91	0.91	0.84	0.84	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	0%	1%	0%	1%	1%
Adj. Flow (vph)	342	542	250	499	298	243	571
Shared Lane Traffic (%)							
Lane Group Flow (vph)	342	542	250	499	0	541	571
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 No-Build Weekday Morning Peak Hour

01/14/2021

	→	↘	↙	←	↗	↖	↘
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effect Green (s)	15.7	63.2	16.2	37.0		16.2	16.2
Actuated g/C Ratio	0.25	1.00	0.26	0.59		0.26	0.26
v/c Ratio	0.64	0.30	0.58	0.25		1.04	0.78
Control Delay	27.7	0.4	27.3	6.5		78.8	16.8
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	27.7	0.4	27.3	6.5		78.8	16.8
LOS	C	A	C	A		E	B
Approach Delay	11.0			13.4		47.0	
Approach LOS	B			B		D	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 63.2

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.04

Intersection Signal Delay: 26.2

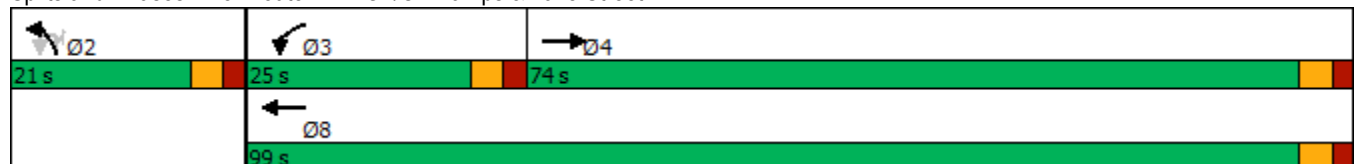
Intersection LOS: C

Intersection Capacity Utilization 67.8%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Queues
5: Route 2 EB On/Off Ramps & Lake Street

2027 No-Build Weekday Morning Peak Hour

01/14/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	342	542	250	499	541	571
v/c Ratio	0.64	0.30	0.58	0.25	1.04	0.78
Control Delay	27.7	0.4	27.3	6.5	78.8	16.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.7	0.4	27.3	6.5	78.8	16.8
Queue Length 50th (ft)	118	0	83	42	~234	54
Queue Length 95th (ft)	204	0	151	57	#482	#243
Internal Link Dist (ft)	159			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	2110	1812	538	3455	520	735
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.30	0.46	0.14	1.04	0.78

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.




















95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street













2027 No-Build Weekday Morning Peak Hour

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	224	607	0	0	478	716	0	0	0	151	6	10
Future Volume (vph)	224	607	0	0	478	716	0	0	0	151	6	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.956	
Satd. Flow (prot)	1805	1881	0	0	1837	1492	0	0	0	1579	1594	1830
Flt Permitted	0.950									0.950	0.956	
Satd. Flow (perm)	1805	1881	0	0	1837	1492	0	0	0	1579	1594	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						490						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.81	0.81	0.81
Heavy Vehicles (%)	0%	1%	0%	0%	0%	1%	0%	0%	0%	5%	50%	0%
Adj. Flow (vph)	255	690	0	0	520	778	0	0	0	186	7	12
Shared Lane Traffic (%)										48%		
Lane Group Flow (vph)	255	690	0	0	520	778	0	0	0	97	96	12
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			11			11	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex				Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 No-Build Weekday Morning Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.0	31.5			16.0	16.0				16.0	16.0	16.0
Actuated g/C Ratio	0.18	0.53			0.27	0.27				0.27	0.27	0.27
v/c Ratio	0.77	0.69			1.05	1.03				0.23	0.22	0.02
Control Delay	40.9	15.0			81.3	51.2				19.0	18.9	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	40.9	15.0			81.3	51.2				19.0	18.9	0.1
LOS	D	B			F	D				B	B	A
Approach Delay		22.0			63.2						17.8	
Approach LOS		C			E						B	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 59.5

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.05

Intersection Signal Delay: 43.5

Intersection LOS: D

Intersection Capacity Utilization 74.8%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Queues
7: Route 2 WB Off Ramp & Lake Street

2027 No-Build Weekday Morning Peak Hour

01/14/2021



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	255	690	520	778	97	96	12
v/c Ratio	0.77	0.69	1.05	1.03	0.23	0.22	0.02
Control Delay	40.9	15.0	81.3	51.2	19.0	18.9	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.9	15.0	81.3	51.2	19.0	18.9	0.1
Queue Length 50th (ft)	88	167	~214	~135	28	28	0
Queue Length 95th (ft)	#179	265	#378	#357	56	55	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	348	1012	494	759	425	429	591
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.68	1.05	1.03	0.23	0.22	0.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 No-Build Weekday Morning Peak Hour

01/14/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations			↑↑↑			↑↑		
Traffic Volume (vph)	0	0	1596	0	0	1062		
Future Volume (vph)	0	0	1596	0	0	1062		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4729	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4729	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						7		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.90	0.92	0.92	0.85		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	1%		
Adj. Flow (vph)	0	0	1773	0	0	1249		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1773	0	0	1249		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 No-Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effect Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			0.85			1.02		
Control Delay			5.6			62.8		
Queue Delay			4.5			0.0		
Total Delay			10.1			62.8		
LOS			B			E		
Approach Delay			10.1		62.8			
Approach LOS			B		E			

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 31.9

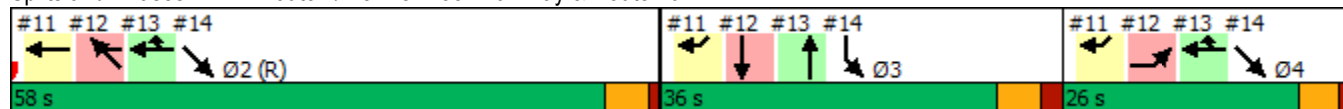
Intersection LOS: C

Intersection Capacity Utilization 84.7%

ICU Level of Service E

Analysis Period (min) 15

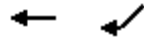
Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Queues
11: Route 2/Alewife Brook Parkway & Route 16

2027 No-Build Weekday Morning Peak Hour

01/14/2021



Lane Group	WBT	SWR
Lane Group Flow (vph)	1773	1249
v/c Ratio	0.85	1.02
Control Delay	5.6	62.8
Queue Delay	4.5	0.0
Total Delay	10.1	62.8
Queue Length 50th (ft)	43	~581
Queue Length 95th (ft)	m40	#659
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2088	1225
Starvation Cap Reductn	252	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.97	1.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

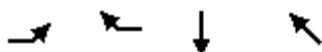
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

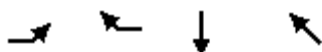
2027 No-Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Lane Configurations	↰↰	↰	↰↰	↰↰
Traffic Volume (vph)	505	169	506	1427
Future Volume (vph)	505	169	506	1427
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3224	1581	3291	3291
Flt Permitted	0.950			
Satd. Flow (perm)	3224	1581	3291	3291
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.97	0.94	0.85	0.90
Heavy Vehicles (%)	1%	6%	2%	2%
Adj. Flow (vph)	521	180	595	1586
Shared Lane Traffic (%)				
Lane Group Flow (vph)	521	180	595	1586
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

2027 No-Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.5
Queue Delay	0.0	2.4	0.0	3.6
Total Delay	72.2	16.7	47.1	89.1
LOS	E	B	D	F
Approach Delay			47.1	89.1
Approach LOS			D	F

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 72.8

Intersection LOS: E

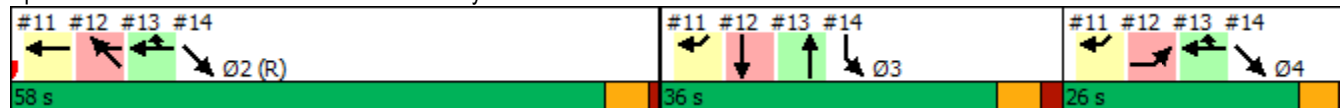
Intersection Capacity Utilization 103.7%

ICU Level of Service G

Analysis Period (min) 15

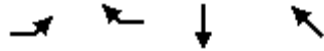
! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



Queues
12: Alewife Brook Parkway & Route 2

2027 No-Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	521	180	595	1586
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.5
Queue Delay	0.0	2.4	0.0	3.6
Total Delay	72.2	16.7	47.1	89.1
Queue Length 50th (ft)	206	86	223	~728
Queue Length 95th (ft)	#308	138	269	#868
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	564	698	822	1453
Starvation Cap Reductn	0	397	0	0
Spillback Cap Reductn	0	6	0	13
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.92	0.60	0.72	1.10

Intersection Summary

















- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lanes, Volumes, Timings

2027 No-Build Weekday Morning Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Future Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	6%	9%	2%	3%	2%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lanes, Volumes, Timings

2027 No-Build Weekday Morning Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.17	0.07		0.32				
Control Delay					8.4	7.6		38.0				
Queue Delay					0.1	0.0		0.0				
Total Delay					8.5	7.6		38.0				
LOS					A	A		D				
Approach Delay					8.3			38.0				
Approach LOS					A			D				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 23.3

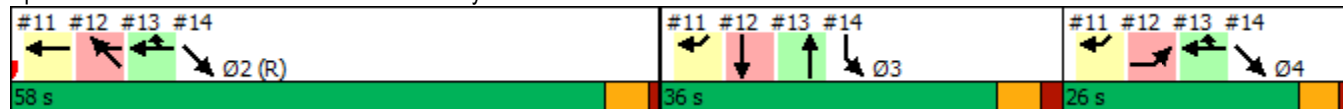
Intersection LOS: C

Intersection Capacity Utilization 27.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Intersection Summary		

Queues

2027 No-Build Weekday Morning Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021

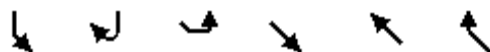


Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	184	59	249
v/c Ratio	0.17	0.07	0.32
Control Delay	8.4	7.6	38.0
Queue Delay	0.1	0.0	0.0
Total Delay	8.5	7.6	38.0
Queue Length 50th (ft)	50	15	83
Queue Length 95th (ft)	81	31	121
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1061	877	788
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	223	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.22	0.07	0.32
Intersection Summary			

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 No-Build Weekday Morning Peak Hour

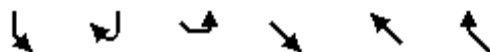
01/14/2021



Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations	↑↑			↑↑				
Traffic Volume (vph)	506	0	0	1102	0	0		
Future Volume (vph)	506	0	0	1102	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Flt								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	216							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.85	0.92	0.92	0.97	0.92	0.92		
Heavy Vehicles (%)	2%	2%	2%	1%	2%	2%		
Adj. Flow (vph)	595	0	0	1136	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	595	0	0	1136	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 No-Build Weekday Morning Peak Hour
01/14/2021



Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effct Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.62			0.52				
Control Delay	2.8			11.7				
Queue Delay	1.0			0.0				
Total Delay	3.7			11.7				
LOS	A			B				
Approach Delay	3.7			11.7				
Approach LOS	A			B				

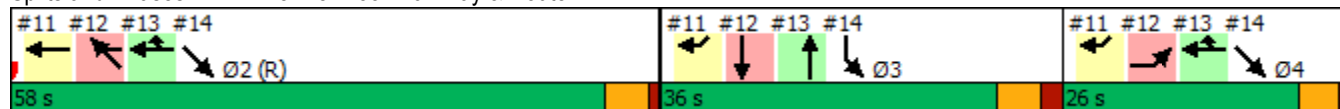
Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.09
Intersection Signal Delay: 9.0
Intersection Capacity Utilization 59.1%
Analysis Period (min) 15

Intersection LOS: A

ICU Level of Service B

Splits and Phases: 14: Alewife Brook Parkway & Route 2



Queues

2027 No-Build Weekday Morning Peak Hour

01/14/2021

14: Alewife Brook Parkway & Route 2

















Lane Group	SBL	SET
Lane Group Flow (vph)	595	1136
v/c Ratio	0.62	0.52
Control Delay	2.8	11.7
Queue Delay	1.0	0.0
Total Delay	3.7	11.7
Queue Length 50th (ft)	5	220
Queue Length 95th (ft)	0	272
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	960	2188
Starvation Cap Reductn	156	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.74	0.52
Intersection Summary		

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 No-Build Weekday Morning Peak Hour













01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	618	0	0	1163	0	0	0	0	0	0	0
Future Volume (vph)	0	618	0	0	1163	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr t												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	736	0	0	1199	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	736	0	0	1199	0	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 No-Build Weekday Morning Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0			4.0								
Minimum Split (s)	20.5			20.5								
Total Split (s)	47.0			47.0								
Total Split (%)	67.1%			67.1%								
Maximum Green (s)	42.5			42.5								
Yellow Time (s)	3.5			3.5								
All-Red Time (s)	1.0			1.0								
Lost Time Adjust (s)	0.0			0.0								
Total Lost Time (s)	4.5			4.5								
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			3.0								
Recall Mode	C-Max			C-Max								
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	47.5			47.5								
Actuated g/C Ratio	0.68			0.68								
v/c Ratio	0.53			0.82								
Control Delay	7.4			17.3								
Queue Delay	53.1			50.4								
Total Delay	60.4			67.6								
LOS	E			E								
Approach Delay	60.4			67.6								
Approach LOS	E			E								
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green												
Natural Cycle: 75												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.82												
Intersection Signal Delay: 64.9							Intersection LOS: E					
Intersection Capacity Utilization 65.0%							ICU Level of Service C					
Analysis Period (min) 15												

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	23.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	304
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
36: Minuteman Commuter Bikeway & Lake Street

2027 No-Build Weekday Morning Peak Hour

01/14/2021



















Lane Group	EBT	WBT
Lane Group Flow (vph)	736	1199
v/c Ratio	0.53	0.82
Control Delay	7.4	17.3
Queue Delay	53.1	50.4
Total Delay	60.4	67.6
Queue Length 50th (ft)	132	569
Queue Length 95th (ft)	180	m580
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	729
Spillback Cap Reductn	804	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.26	1.64

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street













2027 No-Build Weekday Morning Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	541	46	6	1004	0	38	4	5	3	7	121
Future Volume (vph)	31	541	46	6	1004	0	38	4	5	3	7	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990						0.985			0.875	
Flt Protected		0.998						0.961			0.999	
Satd. Flow (prot)	0	1978	0	0	1944	0	0	1799	0	0	1661	0
Flt Permitted		0.918			0.997			0.487			0.993	
Satd. Flow (perm)	0	1819	0	0	1938	0	0	911	0	0	1651	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6						7			155	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.91	0.91	0.91	0.87	0.87	0.87	0.75	0.75	0.75	0.78	0.78	0.78
Heavy Vehicles (%)	0%	1%	5%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	34	595	51	7	1154	0	51	5	7	4	9	155
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	680	0	0	1161	0	0	63	0	0	168	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		2			6		3	8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		3	8		4	4	

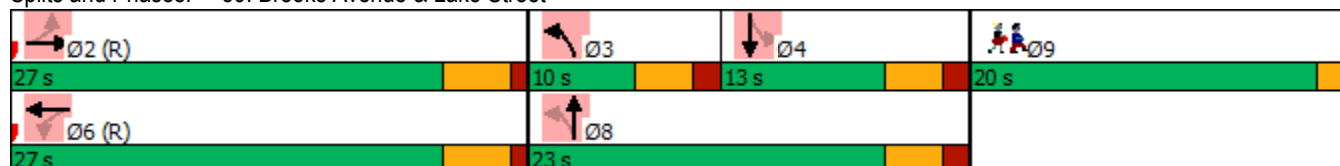
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 No-Build Weekday Morning Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		9.0	21.0		13.0	13.0	
Total Split (s)	27.0	27.0		27.0	27.0		10.0	23.0		13.0	13.0	
Total Split (%)	38.6%	38.6%		38.6%	38.6%		14.3%	32.9%		18.6%	18.6%	
Maximum Green (s)	22.5	22.5		22.5	22.5		5.5	18.5		8.5	8.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		40.9			40.9			9.3			9.3	
Actuated g/C Ratio		0.58			0.58			0.13			0.13	
v/c Ratio		0.64			1.03			0.50			0.48	
Control Delay		23.3			56.0			38.1			10.7	
Queue Delay		29.6			31.1			0.0			0.4	
Total Delay		52.9			87.1			38.1			11.2	
LOS		D			F			D			B	
Approach Delay		52.9			87.1			38.1			11.2	
Approach LOS		D			F			D			B	
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection												
Natural Cycle: 110												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 1.03												
Intersection Signal Delay: 68.2												
Intersection LOS: E												
Intersection Capacity Utilization 77.4%												
ICU Level of Service D												
Analysis Period (min) 15												

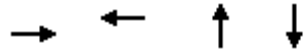
Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	52
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
39: Brooks Avenue & Lake Street

2027 No-Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	680	1161	63	168
v/c Ratio	0.64	1.03	0.50	0.48
Control Delay	23.3	56.0	38.1	10.7
Queue Delay	29.6	31.1	0.0	0.4
Total Delay	52.9	87.1	38.1	11.2
Queue Length 50th (ft)	246	~635	23	5
Queue Length 95th (ft)	#442	#877	44	35
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1065	1132	245	372
Starvation Cap Reductn	411	0	0	0
Spillback Cap Reductn	0	478	1	37
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.04	1.78	0.26	0.50




Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.




Queue shown is maximum after two cycles.

Intersection						
Int Delay, s/veh	0.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	614	3	1	1189	5	1
Future Vol, veh/h	614	3	1	1189	5	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	87	87	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	819	4	1	1367	7	1

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	823
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	816
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	816
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	74
HCM LOS			F




Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	60	-	-	816	-
HCM Lane V/C Ratio	0.133	-	-	0.001	-
HCM Control Delay (s)	74	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0	-

Intersection						
Int Delay, s/veh	2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	601	14	5	1166	24	6
Future Vol, veh/h	601	14	5	1166	24	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	801	19	5	1254	32	8

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	820
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	818
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	818
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	107.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	71	-	-	818	-
HCM Lane V/C Ratio	0.563	-	-	0.007	-
HCM Control Delay (s)	107.5	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	2.4	-	-	0	-

Intersection						
Int Delay, s/veh	0.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	605	5	3	1164	7	1
Future Vol, veh/h	605	5	3	1164	7	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	807	7	3	1252	9	1

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	814	0	2069
Stage 1	-	-	-	-	811
Stage 2	-	-	-	-	1258
Critical Hdwy	-	-	4.1	-	6.4
Critical Hdwy Stg 1	-	-	-	-	5.4
Critical Hdwy Stg 2	-	-	-	-	5.4
Follow-up Hdwy	-	-	2.2	-	3.5
Pot Cap-1 Maneuver	-	-	822	-	60
Stage 1	-	-	-	-	440
Stage 2	-	-	-	-	270
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	822	-	59
Mov Cap-2 Maneuver	-	-	-	-	59
Stage 1	-	-	-	-	440
Stage 2	-	-	-	-	267

Approach	EB	WB	NB
HCM Control Delay, s	0	0	69.8
HCM LOS			F





Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	66	-	-	822	-
HCM Lane V/C Ratio	0.162	-	-	0.004	-
HCM Control Delay (s)	69.8	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	585	18	8	1148	5	8	0	14	4	0	11
Future Vol, veh/h	0	585	18	8	1148	5	8	0	14	4	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	96	96	96	80	80	80	92	92	92
Heavy Vehicles, %	0	1	0	0	0	0	0	0	10	0	0	0
Mvmt Flow	0	741	23	8	1196	5	10	0	18	4	0	12

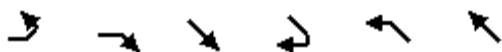
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1201	0	0	764	0	0	1974	1970	753	1977	1979	1199
Stage 1	-	-	-	-	-	-	753	753	-	1215	1215	-
Stage 2	-	-	-	-	-	-	1221	1217	-	762	764	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.3	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.39	3.5	4	3.3
Pot Cap-1 Maneuver	588	-	-	858	-	-	47	63	397	47	62	228
Stage 1	-	-	-	-	-	-	405	420	-	224	256	-
Stage 2	-	-	-	-	-	-	222	256	-	400	416	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	588	-	-	858	-	-	44	61	397	44	60	228
Mov Cap-2 Maneuver	-	-	-	-	-	-	44	61	-	44	60	-
Stage 1	-	-	-	-	-	-	405	420	-	224	249	-
Stage 2	-	-	-	-	-	-	204	249	-	382	416	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	53.5	44.2
HCM LOS			F	E

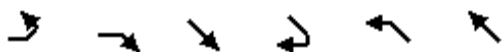
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	101	588	-	-	858	-	-	108
HCM Lane V/C Ratio	0.272	-	-	-	0.01	-	-	0.151
HCM Control Delay (s)	53.5	0	-	-	9.2	0	-	44.2
HCM Lane LOS	F	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	0.5

Intersection												
Int Delay, s/veh	4.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	593	7	24	1136	3	9	0	22	3	0	16
Future Vol, veh/h	3	593	7	24	1136	3	9	0	22	3	0	16
Conflicting Peds, #/hr	0	0	0	304	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	97	97	97	75	75	75	75	75	75
Heavy Vehicles, %	0	2	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	4	706	8	25	1171	3	12	0	29	4	0	21
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1174	0	0	1018	0	0	2255	2246	1014	1956	2249	1173
Stage 1	-	-	-	-	-	-	1022	1022	-	1223	1223	-
Stage 2	-	-	-	-	-	-	1233	1224	-	733	1026	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	602	-	-	689	-	-	30	42	292	49	42	236
Stage 1	-	-	-	-	-	-	287	316	-	221	254	-
Stage 2	-	-	-	-	-	-	219	254	-	415	315	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	602	-	-	514	-	-	18	27	218	38	27	236
Mov Cap-2 Maneuver	-	-	-	-	-	-	18	27	-	38	27	-
Stage 1	-	-	-	-	-	-	212	234	-	219	218	-
Stage 2	-	-	-	-	-	-	171	218	-	355	233	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.3			192.1			39.6		
HCM LOS							F			E		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	52	602	-	-	514	-	-	129				
HCM Lane V/C Ratio	0.795	0.006	-	-	0.048	-	-	0.196				
HCM Control Delay (s)	192.1	11	0	-	12.4	0	-	39.6				
HCM Lane LOS	F	B	A	-	B	A	-	E				
HCM 95th %tile Q(veh)	3.3	0	-	-	0.2	-	-	0.7				

2027 No-Build Weekday Evening Peak Hour Previous Program



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	430	277	658	189	348	739	
Future Volume (vph)	430	277	658	189	348	739	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2046	1830	3421	1507	1745	1863	
Flt Permitted	0.950				0.220		
Satd. Flow (perm)	2046	1830	3421	1507	404	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		140		85			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.88	0.88	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	0%	0%	2%	0%	0%	2%	
Adj. Flow (vph)	489	315	715	205	378	803	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	489	315	715	205	378	803	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effect Green (s)	22.2	22.2	31.3	31.3	47.5	46.5	
Actuated g/C Ratio	0.24	0.24	0.34	0.34	0.51	0.50	
v/c Ratio	1.01	0.58	0.62	0.37	1.13	0.87	
Control Delay	80.9	23.3	30.4	17.2	110.9	34.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	80.9	23.3	30.4	17.2	110.9	34.8	
LOS	F	C	C	B	F	C	
Approach Delay	58.3		27.5			59.2	
Approach LOS	E		C			E	

Intersection Summary

Area Type: Other

Cycle Length: 105

Actuated Cycle Length: 93.4

Natural Cycle: 100

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.13

Intersection Signal Delay: 48.9






Intersection LOS: D

Intersection Capacity Utilization 78.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 2: Massachusetts Avenue/Massachusetts Avenue & Lake Street

		
53 s	29 s	23 s
		
15 s	38 s	



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	489	315	715	205	378	803
v/c Ratio	1.01	0.58	0.62	0.37	1.13	0.87
Control Delay	80.9	23.3	30.4	17.2	110.9	34.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.9	23.3	30.4	17.2	110.9	34.8
Queue Length 50th (ft)	~359	100	211	58	~217	480
Queue Length 95th (ft)	#537	185	277	122	#422	#740
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	486	542	1147	561	335	927
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.58	0.62	0.37	1.13	0.87

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.














95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 No-Build Weekday Evening Peak Hour

01/14/2021

							
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	545	181	171	302	14	531	632
Future Volume (vph)	545	181	171	302	14	531	632
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2153	1664	1652	3490	0	2046	1723
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2153	1664	1652	3490	0	2046	1723
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		70					441
Link Speed (mph)	30			30		30	
Link Distance (ft)	373			505		387	
Travel Time (s)	8.5			11.5		8.8	
Peak Hour Factor	0.94	0.94	0.87	0.87	0.96	0.96	0.96
Heavy Vehicles (%)	0%	10%	2%	0%	0%	0%	0%
Adj. Flow (vph)	580	193	197	347	15	553	658
Shared Lane Traffic (%)							
Lane Group Flow (vph)	580	193	197	347	0	568	658
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 No-Build Weekday Evening Peak Hour

01/14/2021

	→	↘	↙	←	↖	↗	↘
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effct Green (s)	25.7	71.5	14.1	44.9		16.4	16.4
Actuated g/C Ratio	0.36	1.00	0.20	0.63		0.23	0.23
v/c Ratio	0.75	0.12	0.61	0.16		1.21	0.90
Control Delay	26.9	0.1	36.1	5.3		144.0	27.9
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	26.9	0.1	36.1	5.3		144.0	27.9
LOS	C	A	D	A		F	C
Approach Delay	20.3			16.4		81.7	
Approach LOS	C			B		F	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 71.5

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.21

Intersection Signal Delay: 49.1

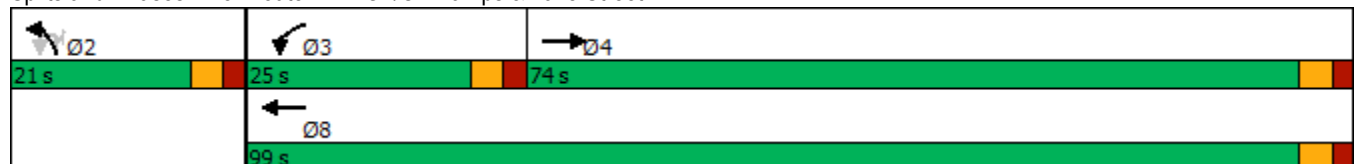
Intersection LOS: D

Intersection Capacity Utilization 80.9%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Queues
5: Route 2 EB On/Off Ramps & Lake Street

2027 No-Build Weekday Evening Peak Hour

01/14/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	580	193	197	347	568	658
v/c Ratio	0.75	0.12	0.61	0.16	1.21	0.90
Control Delay	26.9	0.1	36.1	5.3	144.0	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.9	0.1	36.1	5.3	144.0	27.9
Queue Length 50th (ft)	215	0	79	28	~315	90
Queue Length 95th (ft)	361	0	156	40	#634	#361
Internal Link Dist (ft)	293			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	2001	1664	472	3490	468	734
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.12	0.42	0.10	1.21	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.




















95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 No-Build Weekday Evening Peak Hour













01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	368	809	0	0	265	346	0	0	0	208	22	25
Future Volume (vph)	368	809	0	0	265	346	0	0	0	208	22	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.961	
Satd. Flow (prot)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Flt Permitted	0.950									0.950	0.961	
Satd. Flow (perm)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						380						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.91	0.91	0.91	0.92	0.92	0.92	0.95	0.95	0.95
Heavy Vehicles (%)	0%	1%	0%	0%	2%	3%	0%	0%	0%	1%	5%	0%
Adj. Flow (vph)	418	919	0	0	291	380	0	0	0	219	23	26
Shared Lane Traffic (%)										45%		
Lane Group Flow (vph)	418	919	0	0	291	380	0	0	0	120	122	26
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			11			11	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex				Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 No-Build Weekday Evening Peak Hour

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.5	30.6			14.6	14.6				16.0	16.0	16.0
Actuated g/C Ratio	0.20	0.52			0.25	0.25				0.27	0.27	0.27
v/c Ratio	1.18	0.94			0.65	0.59				0.27	0.26	0.04
Control Delay	134.8	32.4			27.2	6.6				19.4	19.3	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	134.8	32.4			27.2	6.6				19.4	19.3	0.1
LOS	F	C			C	A				B	B	A
Approach Delay		64.4			15.5						17.5	
Approach LOS		E			B						B	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 58.7

Natural Cycle: 65

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.18

Intersection Signal Delay: 44.5

Intersection LOS: D

Intersection Capacity Utilization 61.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Queues
7: Route 2 WB Off Ramp & Lake Street

2027 No-Build Weekday Evening Peak Hour

01/14/2021



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	418	919	291	380	120	122	26
v/c Ratio	1.18	0.94	0.65	0.59	0.27	0.26	0.04
Control Delay	134.8	32.4	27.2	6.6	19.4	19.3	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	134.8	32.4	27.2	6.6	19.4	19.3	0.1
Queue Length 50th (ft)	~191	275	92	0	35	36	0
Queue Length 95th (ft)	#331	#503	162	56	75	76	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	353	1027	492	675	448	465	598
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.18	0.89	0.59	0.56	0.27	0.26	0.04

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 No-Build Weekday Evening Peak Hour

01/14/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations			↑↑↑			↑↑		
Traffic Volume (vph)	0	0	2209	0	0	1131		
Future Volume (vph)	0	0	2209	0	0	1131		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4776	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4776	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						1		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.97	0.97	0.98	0.98		
Heavy Vehicles (%)	2%	2%	1%	0%	0%	1%		
Adj. Flow (vph)	0	0	2277	0	0	1154		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	2277	0	0	1154		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 No-Build Weekday Evening Peak Hour
01/14/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effect Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			1.08			0.95		
Control Delay			46.7			46.7		
Queue Delay			1.5			0.0		
Total Delay			48.2			46.7		
LOS			D			D		
Approach Delay			48.2		46.7			
Approach LOS			D		D			

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 47.7

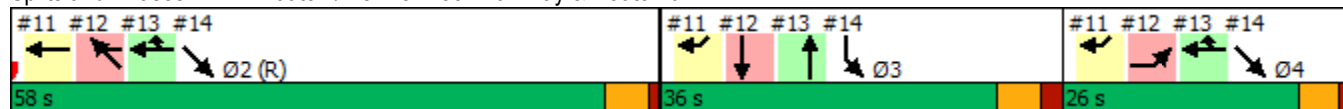
Intersection LOS: D

Intersection Capacity Utilization 100.6%

ICU Level of Service G

Analysis Period (min) 15

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Queues
11: Route 2/Alewife Brook Parkway & Route 16

2027 No-Build Weekday Evening Peak Hour

01/14/2021



Lane Group	WBT	SWR
Lane Group Flow (vph)	2277	1154
v/c Ratio	1.08	0.95
Control Delay	46.7	46.7
Queue Delay	1.5	0.0
Total Delay	48.2	46.7
Queue Length 50th (ft)	~702	472
Queue Length 95th (ft)	m#57	#644
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2109	1221
Starvation Cap Reductn	7	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.08	0.95

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

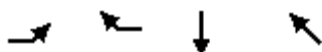
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

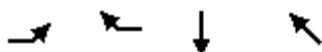
2027 No-Build Weekday Evening Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Lane Configurations	↰↰	↰	↰↰	↰↰
Traffic Volume (vph)	610	591	250	1618
Future Volume (vph)	610	591	250	1618
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3257	1660	3291	3324
Flt Permitted	0.950			
Satd. Flow (perm)	3257	1660	3291	3324
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.90	0.95	0.98	0.97
Heavy Vehicles (%)	0%	1%	2%	1%
Adj. Flow (vph)	678	622	255	1668
Shared Lane Traffic (%)				
Lane Group Flow (vph)	678	622	255	1668
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

2027 No-Build Weekday Evening Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	102.5
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	102.8
LOS	F	C	D	F
Approach Delay			37.8	102.8
Approach LOS			D	F

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 93.2

Intersection LOS: F

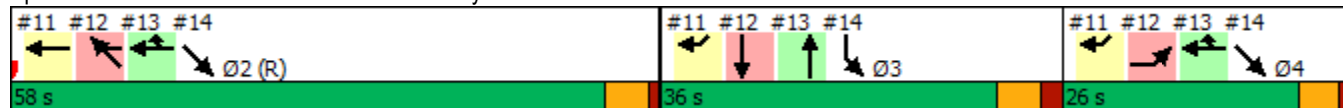
Intersection Capacity Utilization 134.7%

ICU Level of Service H

Analysis Period (min) 15

! Phase conflict between lane groups.

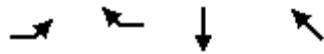
Splits and Phases: 12: Alewife Brook Parkway & Route 2



Queues
12: Alewife Brook Parkway & Route 2

2027 No-Build Weekday Evening Peak Hour

01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	678	622	255	1668
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	102.5
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	102.8
Queue Length 50th (ft)	~326	422	84	~792
Queue Length 95th (ft)	#446	#639	123	#931
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	569	733	822	1468
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	53	0	107
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.19	0.91	0.31	1.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.













Queue shown is maximum after two cycles.

Lanes, Volumes, Timings

2027 No-Build Weekday Evening Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑	↗		↑↑				
Traffic Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Future Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.95	0.95	0.95	0.97	0.97	0.97	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	1%	1%	0%	1%	0%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lanes, Volumes, Timings

2027 No-Build Weekday Evening Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.56	0.36		0.30				
Control Delay					13.5	10.5		37.8				
Queue Delay					2.1	0.0		0.0				
Total Delay					15.6	10.5		37.8				
LOS					B	B		D				
Approach Delay					13.8			37.8				
Approach LOS					B			D				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 18.6

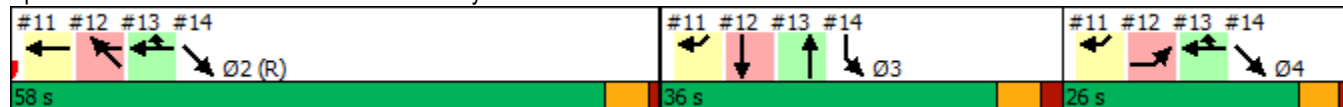
Intersection LOS: B

Intersection Capacity Utilization 52.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Intersection Summary		

Queues

2027 No-Build Weekday Evening Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021













Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	622	345	245
v/c Ratio	0.56	0.36	0.30
Control Delay	13.5	10.5	37.8
Queue Delay	2.1	0.0	0.0
Total Delay	15.6	10.5	37.8
Queue Length 50th (ft)	239	110	81
Queue Length 95th (ft)	337	165	119
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1114	947	804
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	337	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.80	0.36	0.30
Intersection Summary			

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

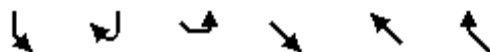
2027 No-Build Weekday Evening Peak Hour

01/14/2021

								
Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations	 			 				
Traffic Volume (vph)	250	0	0	987	0	0		
Future Volume (vph)	250	0	0	987	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Fr								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	234							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.98	0.98	0.90	0.90	0.92	0.92		
Heavy Vehicles (%)	2%	0%	0%	1%	2%	2%		
Adj. Flow (vph)	255	0	0	1097	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	255	0	0	1097	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 No-Build Weekday Evening Peak Hour
01/14/2021



Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effect Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.26			0.50				
Control Delay	0.8			11.4				
Queue Delay	0.5			0.0				
Total Delay	1.3			11.4				
LOS	A			B				
Approach Delay	1.3			11.4				
Approach LOS	A			B				

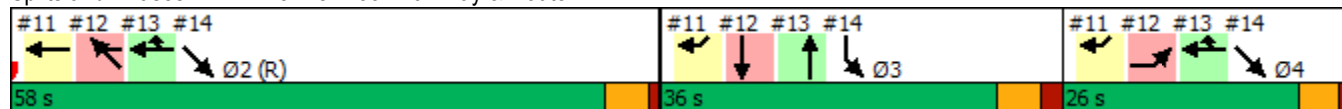
Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.19
Intersection Signal Delay: 9.5
Intersection Capacity Utilization 47.8%
Analysis Period (min) 15

Intersection LOS: A

ICU Level of Service A


Splits and Phases: 14: Alewife Brook Parkway & Route 2



Queues
14: Alewife Brook Parkway & Route 2

2027 No-Build Weekday Evening Peak Hour

01/14/2021















Lane Group	SBL	SET
Lane Group Flow (vph)	255	1097
v/c Ratio	0.26	0.50
Control Delay	0.8	11.4
Queue Delay	0.5	0.0
Total Delay	1.3	11.4
Queue Length 50th (ft)	0	209
Queue Length 95th (ft)	1	258
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	973	2188
Starvation Cap Reductn	391	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.44	0.50
Intersection Summary		

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 No-Build Weekday Evening Peak Hour













01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑							
Traffic Volume (vph)	0	852	0	0	653	0	0	0	0	0	0	0
Future Volume (vph)	0	852	0	0	653	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	1014	0	0	673	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1014	0	0	673	0	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 No-Build Weekday Evening Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.73			0.46							
Control Delay		11.1			6.8							
Queue Delay		51.0			1.7							
Total Delay		62.1			8.5							
LOS		E			A							
Approach Delay		62.1			8.5							
Approach LOS		E			A							
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green												
Natural Cycle: 60												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.73												
Intersection Signal Delay: 40.7												
Intersection LOS: D												
Intersection Capacity Utilization 48.6%												
ICU Level of Service A												
Analysis Period (min) 15												

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	211
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
36: Minuteman Commuter Bikeway & Lake Street

2027 No-Build Weekday Evening Peak Hour

















01/14/2021



Lane Group	EBT	WBT
Lane Group Flow (vph)	1014	673
v/c Ratio	0.73	0.46
Control Delay	11.1	6.8
Queue Delay	51.0	1.7
Total Delay	62.1	8.5
Queue Length 50th (ft)	230	226
Queue Length 95th (ft)	312	169
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	585
Spillback Cap Reductn	655	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.38	0.77
Intersection Summary		

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 No-Build Weekday Evening Peak Hour
01/14/2021













												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	700	70	6	530	1	15	5	7	0	5	108
Future Volume (vph)	82	700	70	6	530	1	15	5	7	0	5	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.989						0.966			0.871	
Flt Protected		0.995			0.999			0.973				
Satd. Flow (prot)	0	1994	0	0	1961	0	0	1786	0	0	1655	0
Flt Permitted		0.893			0.991			0.635				
Satd. Flow (perm)	0	1790	0	0	1946	0	0	1165	0	0	1655	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8						9			140	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.75	0.75	0.75	0.77	0.77	0.77
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	93	795	80	7	602	1	20	7	9	0	6	140
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	968	0	0	610	0	0	36	0	0	146	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

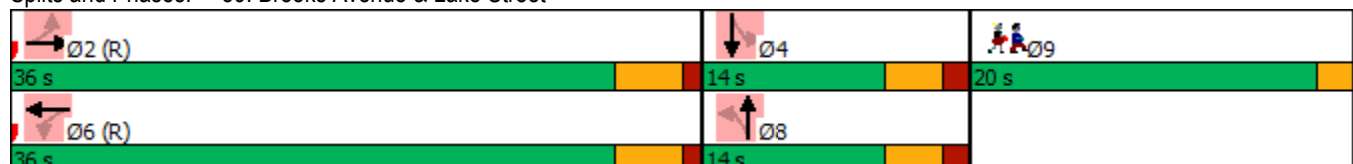
Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 No-Build Weekday Evening Peak Hour

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		14.0	14.0		14.0	14.0	
Total Split (s)	36.0	36.0		36.0	36.0		14.0	14.0		14.0	14.0	
Total Split (%)	51.4%	51.4%		51.4%	51.4%		20.0%	20.0%		20.0%	20.0%	
Maximum Green (s)	31.5	31.5		31.5	31.5		9.5	9.5		9.5	9.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		Min	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		43.2			43.2			7.0			7.0	
Actuated g/C Ratio		0.62			0.62			0.10			0.10	
v/c Ratio		0.87			0.51			0.29			0.50	
Control Delay		26.5			12.2			29.2			12.8	
Queue Delay		47.9			0.6			0.0			0.2	
Total Delay		74.4			12.7			29.2			13.0	
LOS		E			B			C			B	
Approach Delay		74.4			12.7			29.2			13.0	
Approach LOS		E			B			C			B	
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.87												
Intersection Signal Delay: 47.0												
Intersection LOS: D												
Intersection Capacity Utilization 93.3%												
ICU Level of Service F												
Analysis Period (min) 15												

Splits and Phases: 39: Brooks Avenue & Lake Street

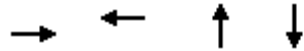


Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	42
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
39: Brooks Avenue & Lake Street

2027 No-Build Weekday Evening Peak Hour

01/14/2021



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	968	610	36	146
v/c Ratio	0.87	0.51	0.29	0.50
Control Delay	26.5	12.2	29.2	12.8
Queue Delay	47.9	0.6	0.0	0.2
Total Delay	74.4	12.7	29.2	13.0
Queue Length 50th (ft)	~274	171	11	2
Queue Length 95th (ft)	#672	284	29	33
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1107	1200	165	345
Starvation Cap Reductn	247	0	0	0
Spillback Cap Reductn	0	254	0	18
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.13	0.64	0.22	0.45




Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.




Queue shown is maximum after two cycles.




Intersection						
Int Delay, s/veh	0.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	831	3	1	602	9	4
Future Vol, veh/h	831	3	1	602	9	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	94	94	75	75
Heavy Vehicles, %	0	0	0	0	29	0
Mvmt Flow	1001	4	1	640	12	5

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1005
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	697
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	697
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	40.3
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	119	-	-	697	-
HCM Lane V/C Ratio	0.146	-	-	0.002	-
HCM Control Delay (s)	40.3	-	-	10.2	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection						
Int Delay, s/veh	0.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	829	6	9	588	15	5
Future Vol, veh/h	829	6	9	588	15	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	953	7	10	661	20	7
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	960	0	1638	957
Stage 1	-	-	-	-	957	-
Stage 2	-	-	-	-	681	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	725	-	112	315
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	506	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	725	-	110	315
Mov Cap-2 Maneuver	-	-	-	-	110	-
Stage 1	-	-	-	-	376	-
Stage 2	-	-	-	-	495	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0.2		39.4	
HCM LOS	E					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	131	-	-	725	-	
HCM Lane V/C Ratio	0.204	-	-	0.014	-	
HCM Control Delay (s)	39.4	-	-	10	0	
HCM Lane LOS	E	-	-	B	A	
HCM 95th %tile Q(veh)	0.7	-	-	0	-	

Intersection						
Int Delay, s/veh	0.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	833	1	1	591	6	4
Future Vol, veh/h	833	1	1	591	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	957	1	1	664	8	5

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	958	0	1624
Stage 1	-	-	-	-	958
Stage 2	-	-	-	-	666
Critical Hdwy	-	-	4.1	-	6.4
Critical Hdwy Stg 1	-	-	-	-	5.4
Critical Hdwy Stg 2	-	-	-	-	5.4
Follow-up Hdwy	-	-	2.2	-	3.5
Pot Cap-1 Maneuver	-	-	726	-	114
Stage 1	-	-	-	-	376
Stage 2	-	-	-	-	515
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	726	-	114
Mov Cap-2 Maneuver	-	-	-	-	114
Stage 1	-	-	-	-	376
Stage 2	-	-	-	-	514

Approach	EB	WB	NB
HCM Control Delay, s	0	0	30.8
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	153	-	-	726	-
HCM Lane V/C Ratio	0.087	-	-	0.002	-
HCM Control Delay (s)	30.8	-	-	10	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	4	814	19	11	578	8	13	1	6	3	0	1
Future Vol, veh/h	4	814	19	11	578	8	13	1	6	3	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	75	75	75	75	75	75
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	5	947	22	13	672	9	17	1	8	4	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	681	0	0	969	0	0	1671	1675	958	1676	1682	677
Stage 1	-	-	-	-	-	-	968	968	-	703	703	-
Stage 2	-	-	-	-	-	-	703	707	-	973	979	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	921	-	-	719	-	-	77	96	315	76	95	456
Stage 1	-	-	-	-	-	-	308	335	-	431	443	-
Stage 2	-	-	-	-	-	-	431	441	-	306	331	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	921	-	-	719	-	-	74	92	315	71	91	456
Mov Cap-2 Maneuver	-	-	-	-	-	-	74	92	-	71	91	-
Stage 1	-	-	-	-	-	-	304	331	-	426	430	-
Stage 2	-	-	-	-	-	-	417	428	-	293	327	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	55.6	47.5
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	97	921	-	-	719	-	-	90
HCM Lane V/C Ratio	0.275	0.005	-	-	0.018	-	-	0.059
HCM Control Delay (s)	55.6	8.9	0	-	10.1	0	-	47.5
HCM Lane LOS	F	A	A	-	B	A	-	E
HCM 95th %tile Q(veh)	1	0	-	-	0.1	-	-	0.2

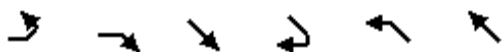
HCM 6th TWSC
33: Margaret Street/Lakehill Avenue & Lake Street

2027 No-Build Weekday Evening Peak Hour

01/04/2021

Intersection												
Int Delay, s/veh	8.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	19	800	4	60	577	16	9	0	43	9	0	11
Future Vol, veh/h	19	800	4	60	577	16	9	0	43	9	0	11
Conflicting Peds, #/hr	0	0	0	304	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	88	88	88	81	81	81	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	23	964	5	68	656	18	11	0	53	11	0	14
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	674	0	0	1273	0	0	2125	2127	1271	1840	2120	665
Stage 1	-	-	-	-	-	-	1317	1317	-	801	801	-
Stage 2	-	-	-	-	-	-	808	810	-	1039	1319	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	927	-	-	552	-	-	37	50	207	59	51	464
Stage 1	-	-	-	-	-	-	196	229	-	381	400	-
Stage 2	-	-	-	-	-	-	378	396	-	281	229	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	927	-	-	412	-	-	20	26	155	30	26	464
Mov Cap-2 Maneuver	-	-	-	-	-	-	20	26	-	30	26	-
Stage 1	-	-	-	-	-	-	138	162	-	360	294	-
Stage 2	-	-	-	-	-	-	270	291	-	175	162	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			1.4			179.4			97.8		
HCM LOS							F			F		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	71	927	-	-	412	-	-	62				
HCM Lane V/C Ratio	0.904	0.025	-	-	0.165	-	-	0.403				
HCM Control Delay (s)	179.4	9	0	-	15.5	0	-	97.8				
HCM Lane LOS	F	A	A	-	C	A	-	F				
HCM 95th %tile Q(veh)	4.5	0.1	-	-	0.6	-	-	1.5				

2027 Build Weekday Morning Peak Hour Previous Program



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	261	295	851	609	403	454	
Future Volume (vph)	261	295	851	609	403	454	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2025	1812	3421	1492	1728	1863	
Flt Permitted	0.950				0.142		
Satd. Flow (perm)	2025	1812	3421	1492	258	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		245		212			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	1%	1%	2%	1%	1%	2%	
Adj. Flow (vph)	287	324	925	662	438	493	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	287	324	925	662	438	493	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	

Lanes, Volumes, Timings
2: Massachusetts Avenue/Massachusetts Avenue & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effect Green (s)	17.2	17.2	31.8	31.8	48.2	47.2	
Actuated g/C Ratio	0.19	0.19	0.36	0.36	0.54	0.53	
v/c Ratio	0.73	0.59	0.76	0.99	1.50	0.50	
Control Delay	46.7	14.3	32.8	55.6	261.8	18.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	46.7	14.3	32.8	55.6	261.8	18.7	
LOS	D	B	C	E	F	B	
Approach Delay	29.5		42.3			133.1	
Approach LOS	C		D			F	

Intersection Summary

Area Type: Other

Cycle Length: 105

Actuated Cycle Length: 88.9

Natural Cycle: 120

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.50

Intersection Signal Delay: 66.8

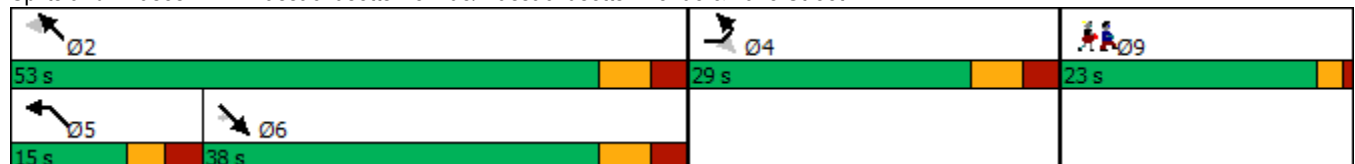
Intersection LOS: E

Intersection Capacity Utilization 77.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 2: Massachusetts Avenue/Massachusetts Avenue & Lake Street





Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	287	324	925	662	438	493
v/c Ratio	0.73	0.59	0.76	0.99	1.50	0.50
Control Delay	46.7	14.3	32.8	55.6	261.8	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.7	14.3	32.8	55.6	261.8	18.7
Queue Length 50th (ft)	170	42	282	~364	~339	214
Queue Length 95th (ft)	259	125	#409	#606	#554	332
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	514	642	1224	669	292	989
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.50	0.76	0.99	1.50	0.50

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.














95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021

							
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	312	493	212	421	271	221	523
Future Volume (vph)	312	493	212	421	271	221	523
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2132	1812	1685	3455	0	2037	1706
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2132	1812	1685	3455	0	2037	1706
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		332					405
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Peak Hour Factor	0.91	0.91	0.84	0.84	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	0%	1%	0%	1%	1%
Adj. Flow (vph)	343	542	252	501	298	243	575
Shared Lane Traffic (%)							
Lane Group Flow (vph)	343	542	252	501	0	541	575
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021

	→	↘	↙	←	↖	↗	↘
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effect Green (s)	15.8	63.5	16.4	37.3		16.1	16.1
Actuated g/C Ratio	0.25	1.00	0.26	0.59		0.25	0.25
v/c Ratio	0.65	0.30	0.58	0.25		1.04	0.78
Control Delay	27.8	0.4	27.3	6.4		80.3	17.0
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	27.8	0.4	27.3	6.4		80.3	17.0
LOS	C	A	C	A		F	B
Approach Delay	11.0			13.4		47.7	
Approach LOS	B			B		D	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 63.5

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.04

Intersection Signal Delay: 26.5

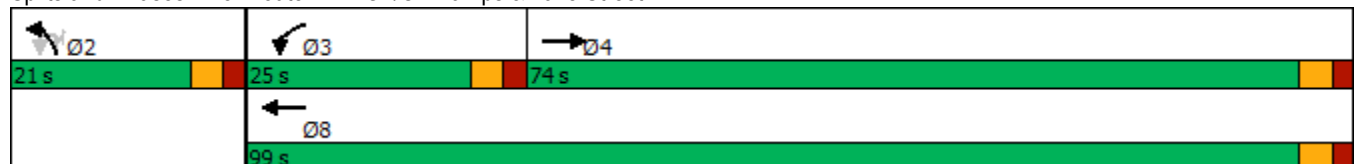
Intersection LOS: C

Intersection Capacity Utilization 67.9%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Queues
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	343	542	252	501	541	575
v/c Ratio	0.65	0.30	0.58	0.25	1.04	0.78
Control Delay	27.8	0.4	27.3	6.4	80.3	17.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	0.4	27.3	6.4	80.3	17.0
Queue Length 50th (ft)	119	0	84	43	~236	55
Queue Length 95th (ft)	205	0	152	57	#482	#246
Internal Link Dist (ft)	159			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	2110	1812	535	3455	518	735
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.30	0.47	0.15	1.04	0.78

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.




















95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 Build Weekday Morning Peak Hour













01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	224	611	0	0	482	725	0	0	0	151	6	11
Future Volume (vph)	224	611	0	0	482	725	0	0	0	151	6	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.956	
Satd. Flow (prot)	1805	1881	0	0	1837	1492	0	0	0	1579	1594	1830
Flt Permitted	0.950									0.950	0.956	
Satd. Flow (perm)	1805	1881	0	0	1837	1492	0	0	0	1579	1594	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						492						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.81	0.81	0.81
Heavy Vehicles (%)	0%	1%	0%	0%	0%	1%	0%	0%	0%	5%	50%	0%
Adj. Flow (vph)	255	694	0	0	524	788	0	0	0	186	7	14
Shared Lane Traffic (%)										48%		
Lane Group Flow (vph)	255	694	0	0	524	788	0	0	0	97	96	14
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			11			11	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex				Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.0	31.5			16.0	16.0				16.0	16.0	16.0
Actuated g/C Ratio	0.18	0.53			0.27	0.27				0.27	0.27	0.27
v/c Ratio	0.77	0.70			1.06	1.04				0.23	0.22	0.02
Control Delay	40.9	15.1			83.8	54.7				19.0	18.9	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	40.9	15.1			83.8	54.7				19.0	18.9	0.1
LOS	D	B			F	D				B	B	A
Approach Delay		22.0			66.3						17.7	
Approach LOS		C			E						B	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 59.5

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.06

Intersection Signal Delay: 45.2

Intersection LOS: D

Intersection Capacity Utilization 75.4%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Queues
7: Route 2 WB Off Ramp & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	255	694	524	788	97	96	14
v/c Ratio	0.77	0.70	1.06	1.04	0.23	0.22	0.02
Control Delay	40.9	15.1	83.8	54.7	19.0	18.9	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.9	15.1	83.8	54.7	19.0	18.9	0.1
Queue Length 50th (ft)	88	168	~217	~169	28	28	0
Queue Length 95th (ft)	#179	268	#381	#364	56	55	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	348	1012	494	760	425	429	591
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.69	1.06	1.04	0.23	0.22	0.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations			↑↑↑			↑↑		
Traffic Volume (vph)	0	0	1597	0	0	1062		
Future Volume (vph)	0	0	1597	0	0	1062		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4729	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4729	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						7		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.90	0.92	0.92	0.85		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	1%		
Adj. Flow (vph)	0	0	1774	0	0	1249		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	1774	0	0	1249		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effect Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			0.85			1.02		
Control Delay			5.6			62.8		
Queue Delay			4.6			0.0		
Total Delay			10.1			62.8		
LOS			B			E		
Approach Delay			10.1		62.8			
Approach LOS			B		E			

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 31.9

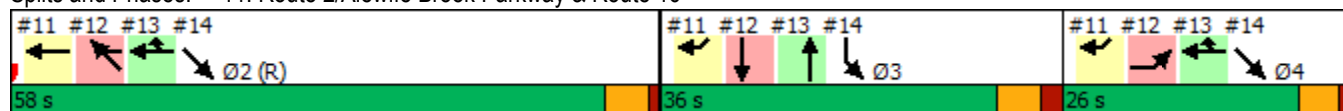
Intersection LOS: C

Intersection Capacity Utilization 84.7%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16





Lane Group	WBT	SWR
Lane Group Flow (vph)	1774	1249
v/c Ratio	0.85	1.02
Control Delay	5.6	62.8
Queue Delay	4.6	0.0
Total Delay	10.1	62.8
Queue Length 50th (ft)	43	~581
Queue Length 95th (ft)	m40	#659
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2088	1225
Starvation Cap Reductn	252	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.97	1.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

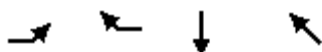
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

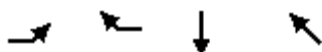
2027 Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Lane Configurations	↰↰	↰	↰↰	↰↰
Traffic Volume (vph)	505	169	506	1428
Future Volume (vph)	505	169	506	1428
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3224	1581	3291	3291
Flt Permitted	0.950			
Satd. Flow (perm)	3224	1581	3291	3291
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.97	0.94	0.85	0.90
Heavy Vehicles (%)	1%	6%	2%	2%
Adj. Flow (vph)	521	180	595	1587
Shared Lane Traffic (%)				
Lane Group Flow (vph)	521	180	595	1587
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.8
Queue Delay	0.0	2.4	0.0	3.3
Total Delay	72.2	16.7	47.1	89.1
LOS	E	B	D	F
Approach Delay			47.1	89.1
Approach LOS			D	F

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 72.8

Intersection LOS: E

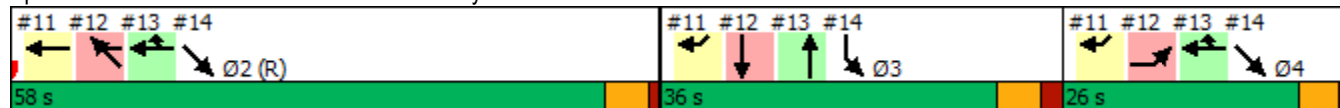
Intersection Capacity Utilization 103.7%

ICU Level of Service G

Analysis Period (min) 15

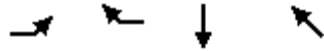
! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



Queues
12: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	521	180	595	1587
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.8
Queue Delay	0.0	2.4	0.0	3.3
Total Delay	72.2	16.7	47.1	89.1
Queue Length 50th (ft)	206	86	223	~730
Queue Length 95th (ft)	#308	138	269	#868
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	564	698	822	1453
Starvation Cap Reductn	0	397	0	0
Spillback Cap Reductn	0	6	0	13
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.92	0.60	0.72	1.10

Intersection Summary

















- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lanes, Volumes, Timings

2027 Build Weekday Morning Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Future Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1613	1333	0	3154	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	6%	9%	2%	3%	2%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

Lanes, Volumes, Timings

2027 Build Weekday Morning Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.17	0.07		0.32				
Control Delay					8.4	7.6		38.0				
Queue Delay					0.1	0.0		0.0				
Total Delay					8.5	7.6		38.0				
LOS					A	A		D				
Approach Delay					8.3			38.0				
Approach LOS					A			D				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 23.3

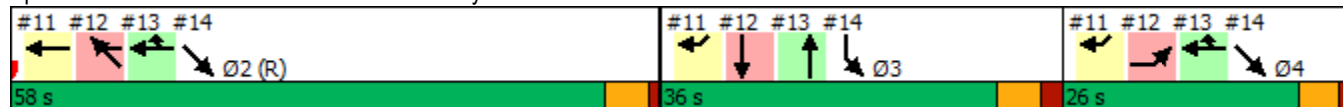
Intersection LOS: C

Intersection Capacity Utilization 27.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Intersection Summary		

Queues

2027 Build Weekday Morning Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access









01/14/2021



Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	184	59	249
v/c Ratio	0.17	0.07	0.32
Control Delay	8.4	7.6	38.0
Queue Delay	0.1	0.0	0.0
Total Delay	8.5	7.6	38.0
Queue Length 50th (ft)	50	15	83
Queue Length 95th (ft)	81	31	121
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1061	877	788
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	223	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.22	0.07	0.32
Intersection Summary			

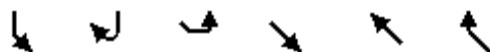
Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour
01/14/2021

								
Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	506	0	0	1104	0	0		
Future Volume (vph)	506	0	0	1104	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Fr								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	215							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.85	0.92	0.92	0.97	0.92	0.92		
Heavy Vehicles (%)	2%	2%	2%	1%	2%	2%		
Adj. Flow (vph)	595	0	0	1138	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	595	0	0	1138	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour
01/14/2021



Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effect Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.62			0.52				
Control Delay	2.8			11.7				
Queue Delay	1.0			0.0				
Total Delay	3.7			11.7				
LOS	A			B				
Approach Delay	3.7			11.7				
Approach LOS	A			B				

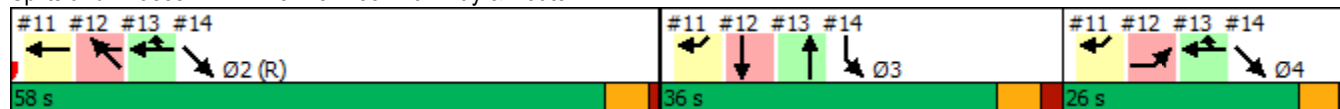
Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.09
Intersection Signal Delay: 9.0
Intersection Capacity Utilization 59.1%
Analysis Period (min) 15

Intersection LOS: A

ICU Level of Service B


Splits and Phases: 14: Alewife Brook Parkway & Route 2



Queues
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour

01/14/2021















Lane Group	SBL	SET
Lane Group Flow (vph)	595	1138
v/c Ratio	0.62	0.52
Control Delay	2.8	11.7
Queue Delay	1.0	0.0
Total Delay	3.7	11.7
Queue Length 50th (ft)	5	221
Queue Length 95th (ft)	0	272
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	959	2188
Starvation Cap Reductn	155	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.74	0.52
Intersection Summary		

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Morning Peak Hour













01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑							
Traffic Volume (vph)	0	625	0	0	1165	0	0	0	0	0	0	0
Future Volume (vph)	0	625	0	0	1165	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	744	0	0	1201	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	744	0	0	1201	0	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

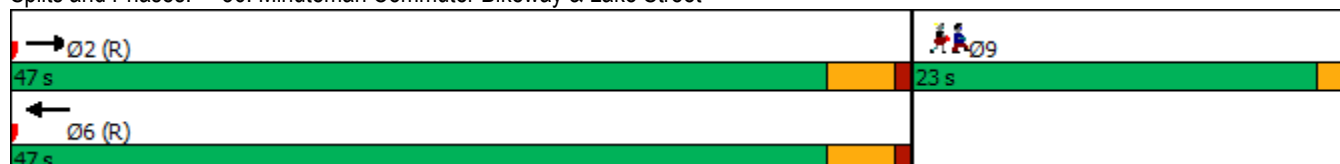
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Morning Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0			4.0								
Minimum Split (s)	20.5			20.5								
Total Split (s)	47.0			47.0								
Total Split (%)	67.1%			67.1%								
Maximum Green (s)	42.5			42.5								
Yellow Time (s)	3.5			3.5								
All-Red Time (s)	1.0			1.0								
Lost Time Adjust (s)	0.0			0.0								
Total Lost Time (s)	4.5			4.5								
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			3.0								
Recall Mode	C-Max			C-Max								
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	47.5			47.5								
Actuated g/C Ratio	0.68			0.68								
v/c Ratio	0.54			0.82								
Control Delay	7.4			17.3								
Queue Delay	53.2			50.3								
Total Delay	60.6			67.7								
LOS	E			E								
Approach Delay	60.6			67.7								
Approach LOS	E			E								
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green												
Natural Cycle: 60												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.82												
Intersection Signal Delay: 65.0							Intersection LOS: E					
Intersection Capacity Utilization 65.1%							ICU Level of Service C					
Analysis Period (min) 15												

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street

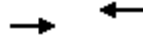


Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	311
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021



Lane Group	EBT	WBT
Lane Group Flow (vph)	744	1201
v/c Ratio	0.54	0.82
Control Delay	7.4	17.3
Queue Delay	53.2	50.3
Total Delay	60.6	67.7
Queue Length 50th (ft)	134	570
Queue Length 95th (ft)	182	m580
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	729
Spillback Cap Reductn	812	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.29	1.64

















Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021













												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	548	46	6	1006	0	38	4	5	3	7	121
Future Volume (vph)	31	548	46	6	1006	0	38	4	5	3	7	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990						0.985			0.875	
Flt Protected		0.998						0.961			0.999	
Satd. Flow (prot)	0	1978	0	0	1944	0	0	1799	0	0	1661	0
Flt Permitted		0.919			0.997			0.487			0.993	
Satd. Flow (perm)	0	1821	0	0	1938	0	0	911	0	0	1651	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6						7			155	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.91	0.91	0.91	0.87	0.87	0.87	0.75	0.75	0.75	0.78	0.78	0.78
Heavy Vehicles (%)	0%	1%	5%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	34	602	51	7	1156	0	51	5	7	4	9	155
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	687	0	0	1163	0	0	63	0	0	168	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		2			6		3	8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		3	8		4	4	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

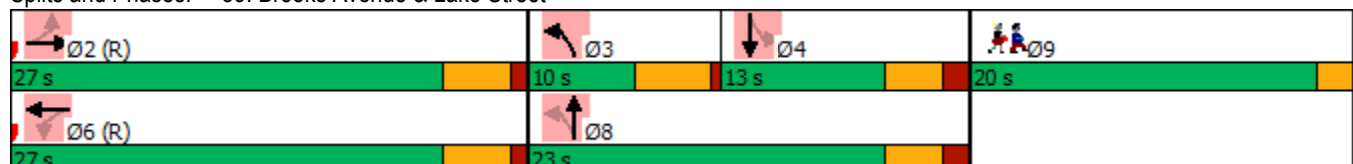
Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 Build Weekday Morning Peak Hour

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		8.5	14.0		13.0	13.0	
Total Split (s)	27.0	27.0		27.0	27.0		10.0	23.0		13.0	13.0	
Total Split (%)	38.6%	38.6%		38.6%	38.6%		14.3%	32.9%		18.6%	18.6%	
Maximum Green (s)	22.5	22.5		22.5	22.5		5.5	18.5		8.5	8.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		4.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		0.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		40.9			40.9			9.3			9.3	
Actuated g/C Ratio		0.58			0.58			0.13			0.13	
v/c Ratio		0.64			1.03			0.50			0.48	
Control Delay		23.5			56.5			38.1			10.7	
Queue Delay		33.2			30.6			0.0			0.4	
Total Delay		56.7			87.1			38.1			11.2	
LOS		E			F			D			B	
Approach Delay		56.7			87.1			38.1			11.2	
Approach LOS		E			F			D			B	
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection												
Natural Cycle: 110												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 1.03												
Intersection Signal Delay: 69.4												
Intersection LOS: E												
Intersection Capacity Utilization 77.5%												
ICU Level of Service D												
Analysis Period (min) 15												

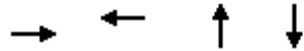
Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	52
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
39: Brooks Avenue & Lake Street




2027 Build Weekday Morning Peak Hour
01/14/2021



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	687	1163	63	168
v/c Ratio	0.64	1.03	0.50	0.48
Control Delay	23.5	56.5	38.1	10.7
Queue Delay	33.2	30.6	0.0	0.4
Total Delay	56.7	87.1	38.1	11.2
Queue Length 50th (ft)	249	~636	23	5
Queue Length 95th (ft)	#448	#879	44	35
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1066	1132	245	372
Starvation Cap Reductn	412	0	0	0
Spillback Cap Reductn	0	482	1	38
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.05	1.79	0.26	0.50

Intersection Summary




- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.




Intersection						
Int Delay, s/veh	0.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	619	3	1	1202	5	1
Future Vol, veh/h	619	3	1	1202	5	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	87	87	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	825	4	1	1382	7	1

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	829
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	811
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	811
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	78.2
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	57	-	-	811	-
HCM Lane V/C Ratio	0.14	-	-	0.001	-
HCM Control Delay (s)	78.2	-	-	9.4	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection						
Int Delay, s/veh	4.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	606	14	5	1166	37	6
Future Vol, veh/h	606	14	5	1166	37	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	808	19	5	1254	49	8
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	827	0	2082	818
Stage 1	-	-	-	-	818	-
Stage 2	-	-	-	-	1264	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	813	-	59	379
Stage 1	-	-	-	-	437	-
Stage 2	-	-	-	-	268	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	813	-	58	379
Mov Cap-2 Maneuver	-	-	-	-	58	-
Stage 1	-	-	-	-	437	-
Stage 2	-	-	-	-	263	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0		179	
HCM LOS					F	
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	66	-	-	813	-	
HCM Lane V/C Ratio	0.869	-	-	0.007	-	
HCM Control Delay (s)	179	-	-	9.5	0	
HCM Lane LOS	F	-	-	A	A	
HCM 95th %tile Q(veh)	4.1	-	-	0	-	

Intersection						
Int Delay, s/veh	0.5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	602	607	3	1164	7	1
Future Vol, veh/h	602	607	3	1164	7	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	803	809	3	1252	9	1

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1612
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	410
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	410
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	137.8
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	37	-	-	410	-
HCM Lane V/C Ratio	0.288	-	-	0.008	-
HCM Control Delay (s)	137.8	-	-	13.8	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	0.9	-	-	0	-

Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	590	18	8	1148	5	8	0	14	4	0	11
Future Vol, veh/h	0	590	18	8	1148	5	8	0	14	4	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	96	96	96	80	80	80	92	92	92
Heavy Vehicles, %	0	1	0	0	0	0	0	0	10	0	0	0
Mvmt Flow	0	747	23	8	1196	5	10	0	18	4	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1201	0	0	770	0	0	1980	1976	759	1983	1985	1199
Stage 1	-	-	-	-	-	-	759	759	-	1215	1215	-
Stage 2	-	-	-	-	-	-	1221	1217	-	768	770	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.3	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.39	3.5	4	3.3
Pot Cap-1 Maneuver	588	-	-	854	-	-	47	63	394	46	62	228
Stage 1	-	-	-	-	-	-	402	418	-	224	256	-
Stage 2	-	-	-	-	-	-	222	256	-	397	413	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	588	-	-	854	-	-	44	61	394	43	60	228
Mov Cap-2 Maneuver	-	-	-	-	-	-	44	61	-	43	60	-
Stage 1	-	-	-	-	-	-	402	418	-	224	249	-
Stage 2	-	-	-	-	-	-	204	249	-	379	413	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	53.5	45
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	101	588	-	-	854	-	-	106
HCM Lane V/C Ratio	0.272	-	-	-	0.01	-	-	0.154
HCM Control Delay (s)	53.5	0	-	-	9.3	0	-	45
HCM Lane LOS	F	A	-	-	A	A	-	E
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	0.5

Intersection												
Int Delay, s/veh	5.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	3	593	12	26	1136	3	9	0	29	3	0	16
Future Vol, veh/h	3	593	12	26	1136	3	9	0	29	3	0	16
Conflicting Peds, #/hr	0	0	0	304	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	97	97	97	75	75	75	75	75	75
Heavy Vehicles, %	0	2	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	4	706	14	27	1171	3	12	0	39	4	0	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1174	0	0	1024	0	0	2262	2253	1017	1968	2259	1173
Stage 1	-	-	-	-	-	-	1025	1025	-	1227	1227	-
Stage 2	-	-	-	-	-	-	1237	1228	-	741	1032	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	602	-	-	686	-	-	29	42	291	48	42	236
Stage 1	-	-	-	-	-	-	286	315	-	220	253	-
Stage 2	-	-	-	-	-	-	217	253	-	411	313	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	602	-	-	512	-	-	17	26	217	35	26	236
Mov Cap-2 Maneuver	-	-	-	-	-	-	17	26	-	35	26	-
Stage 1	-	-	-	-	-	-	211	233	-	218	215	-
Stage 2	-	-	-	-	-	-	167	215	-	334	231	-

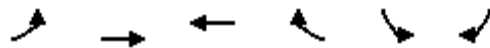
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	204.1	41.3
HCM LOS			F	E




Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	57	602	-	-	512	-	-	124
HCM Lane V/C Ratio	0.889	0.006	-	-	0.052	-	-	0.204
HCM Control Delay (s)	204.1	11	0	-	12.4	0	-	41.3
HCM Lane LOS	F	B	A	-	B	A	-	E
HCM 95th %tile Q(veh)	4	0	-	-	0.2	-	-	0.7

HCM Unsignalized Intersection Capacity Analysis 17: Site Driveway/Dorothy Road & Littlejohn Street

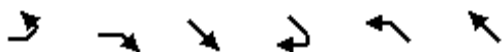
2027 Build Weekday Morning Peak Hour

01/04/2021



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	7	7	30	19	0
Future Volume (Veh/h)	13	7	7	30	19	0
Sign Control		Stop	Stop		Free	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	8	8	33	21	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	79	42	42	0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	79	42	42	0	0	
tC, single (s)	7.1	6.5	6.5	6.2	4.1	
tC, 2 stage (s)						
tF (s)	3.5	4.0	4.0	3.3	2.2	
p0 queue free %	98	99	99	97	99	
cM capacity (veh/h)	872	843	843	1091	1636	
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	22	41	21			
Volume Left	14	0	21			
Volume Right	0	33	0			
cSH	861	1032	1636			
Volume to Capacity	0.03	0.04	0.01			
Queue Length 95th (ft)	2	3	1			
Control Delay (s)	9.3	8.6	7.2			
Lane LOS	A	A	A			
Approach Delay (s)	9.3	8.6	7.2			
Approach LOS	A	A				
Intersection Summary						
Average Delay			8.5			
Intersection Capacity Utilization			17.8%		ICU Level of Service	
Analysis Period (min)			15		A	

2027 Build Weekday Evening Peak Hour Previous Program



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	432	280	658	192	352	739	
Future Volume (vph)	432	280	658	192	352	739	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00	
Frt		0.850		0.850			
Flt Protected	0.950				0.950		
Satd. Flow (prot)	2046	1830	3421	1507	1745	1863	
Flt Permitted	0.950				0.220		
Satd. Flow (perm)	2046	1830	3421	1507	404	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		140		87			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Peak Hour Factor	0.88	0.88	0.92	0.92	0.92	0.92	
Heavy Vehicles (%)	0%	0%	2%	0%	0%	2%	
Adj. Flow (vph)	491	318	715	209	383	803	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	491	318	715	209	383	803	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Right	Left	Left	
Median Width(ft)	16		11			11	
Link Offset(ft)	0		0			0	
Crosswalk Width(ft)	16		16			16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.04	1.09	1.04	1.00	
Turning Speed (mph)	15	9		9	15		
Number of Detectors	1	1	2	1	1	2	
Detector Template	Left	Right	Thru	Right	Left	Thru	
Leading Detector (ft)	20	20	100	20	20	100	
Trailing Detector (ft)	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	
Detector 1 Size(ft)	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)			94			94	
Detector 2 Size(ft)			6			6	
Detector 2 Type			Cl+Ex			Cl+Ex	
Detector 2 Channel							
Detector 2 Extend (s)			0.0			0.0	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effect Green (s)	22.2	22.2	31.3	31.3	47.5	46.5	
Actuated g/C Ratio	0.24	0.24	0.34	0.34	0.51	0.50	
v/c Ratio	1.01	0.59	0.62	0.37	1.14	0.87	
Control Delay	81.8	23.6	30.4	17.2	116.1	34.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	81.8	23.6	30.4	17.2	116.1	34.8	
LOS	F	C	C	B	F	C	
Approach Delay	58.9		27.4			61.1	
Approach LOS	E		C			E	

Intersection Summary

Area Type: Other

Cycle Length: 105

Actuated Cycle Length: 93.4

Natural Cycle: 100

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.14

Intersection Signal Delay: 49.8

Intersection LOS: D

Intersection Capacity Utilization 78.3%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 2: Massachusetts Avenue/Massachusetts Avenue & Lake Street



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Group Flow (vph)	491	318	715	209	383	803
v/c Ratio	1.01	0.59	0.62	0.37	1.14	0.87
Control Delay	81.8	23.6	30.4	17.2	116.1	34.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.8	23.6	30.4	17.2	116.1	34.8
Queue Length 50th (ft)	~362	102	211	59	~224	480
Queue Length 95th (ft)	#541	188	277	124	#433	#740
Internal Link Dist (ft)	1046		560			565
Turn Bay Length (ft)		100		55	150	
Base Capacity (vph)	486	542	1147	562	335	927
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.59	0.62	0.37	1.14	0.87

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.














95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Evening Peak Hour

01/14/2021

							
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	547	181	172	303	14	531	641
Future Volume (vph)	547	181	172	303	14	531	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Lane Util. Factor	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Frt		0.850					0.850
Flt Protected			0.950			0.950	
Satd. Flow (prot)	2153	1664	1652	3490	0	2046	1723
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2153	1664	1652	3490	0	2046	1723
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		70					448
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Peak Hour Factor	0.94	0.94	0.87	0.87	0.96	0.96	0.96
Heavy Vehicles (%)	0%	10%	2%	0%	0%	0%	0%
Adj. Flow (vph)	582	193	198	348	15	553	668
Shared Lane Traffic (%)							
Lane Group Flow (vph)	582	193	198	348	0	568	668
Enter Blocked Intersection	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	R NA	Left	Right
Median Width(ft)	12			12		16	
Link Offset(ft)	0			0		0	
Crosswalk Width(ft)	16			16		16	
Two way Left Turn Lane							
Headway Factor	0.85	0.85	1.09	1.04	1.00	0.85	0.92
Turning Speed (mph)		9	15		9	15	9
Number of Detectors	2	1	1	2	1	1	1
Detector Template	Thru	Right	Left	Thru	Left	Left	Right
Leading Detector (ft)	100	20	20	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel							
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94			
Detector 2 Size(ft)	6			6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Evening Peak Hour

01/14/2021

	→	↘	↙	←	↖	↗	↘
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effect Green (s)	25.8	71.6	14.1	45.0		16.3	16.3
Actuated g/C Ratio	0.36	1.00	0.20	0.63		0.23	0.23
v/c Ratio	0.75	0.12	0.61	0.16		1.22	0.90
Control Delay	27.0	0.1	36.2	5.3		145.5	28.7
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	27.0	0.1	36.2	5.3		145.5	28.7
LOS	C	A	D	A		F	C
Approach Delay	20.3			16.5		82.4	
Approach LOS	C			B		F	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 71.6

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.22

Intersection Signal Delay: 49.5

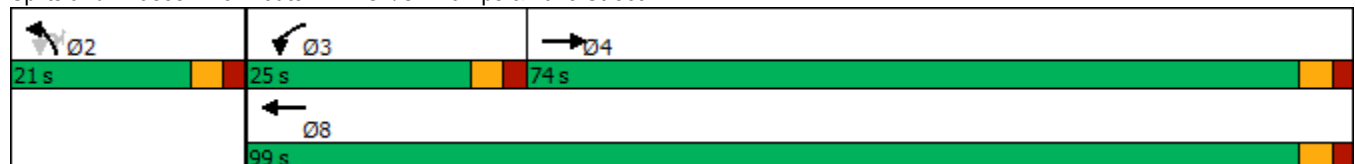
Intersection LOS: D

Intersection Capacity Utilization 81.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Queues
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Evening Peak Hour

01/14/2021

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	582	193	198	348	568	668
v/c Ratio	0.75	0.12	0.61	0.16	1.22	0.90
Control Delay	27.0	0.1	36.2	5.3	145.5	28.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.0	0.1	36.2	5.3	145.5	28.7
Queue Length 50th (ft)	216	0	80	28	~316	93
Queue Length 95th (ft)	362	0	157	40	#635	#368
Internal Link Dist (ft)	159			425	307	
Turn Bay Length (ft)		150	110			
Base Capacity (vph)	1999	1664	471	3490	467	739
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.12	0.42	0.10	1.22	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.




















95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street













2027 Build Weekday Evening Peak Hour

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	368	820	0	0	267	352	0	0	0	208	22	27
Future Volume (vph)	368	820	0	0	267	352	0	0	0	208	22	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950	0.961	
Satd. Flow (prot)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Flt Permitted	0.950									0.950	0.961	
Satd. Flow (perm)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						387						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Peak Hour Factor	0.88	0.88	0.88	0.91	0.91	0.91	0.92	0.92	0.92	0.95	0.95	0.95
Heavy Vehicles (%)	0%	1%	0%	0%	2%	3%	0%	0%	0%	1%	5%	0%
Adj. Flow (vph)	418	932	0	0	293	387	0	0	0	219	23	28
Shared Lane Traffic (%)										45%		
Lane Group Flow (vph)	418	932	0	0	293	387	0	0	0	120	122	28
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			11			11	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.04	1.09	1.00	1.00	1.00	1.04	1.00	0.85
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2	1				1	2	1
Detector Template	Left	Thru			Thru	Right				Left	Thru	Right
Leading Detector (ft)	20	100			100	20				20	100	20
Trailing Detector (ft)	0	0			0	0				0	0	0
Detector 1 Position(ft)	0	0			0	0				0	0	0
Detector 1 Size(ft)	20	6			6	20				20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex				Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Detector 2 Position(ft)		94			94						94	
Detector 2 Size(ft)		6			6						6	
Detector 2 Type		Cl+Ex			Cl+Ex						Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0						0.0	
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 Build Weekday Evening Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.5	31.0			14.9	14.9				16.0	16.0	16.0
Actuated g/C Ratio	0.19	0.53			0.25	0.25				0.27	0.27	0.27
v/c Ratio	1.19	0.94			0.64	0.59				0.27	0.26	0.05
Control Delay	137.1	33.8			26.9	6.5				19.4	19.3	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	137.1	33.8			26.9	6.5				19.4	19.3	0.1
LOS	F	C			C	A				B	B	A
Approach Delay		65.8			15.3						17.4	
Approach LOS		E			B						B	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 59

Natural Cycle: 65

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 45.2

Intersection LOS: D

Intersection Capacity Utilization 62.3%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Queues
7: Route 2 WB Off Ramp & Lake Street

2027 Build Weekday Evening Peak Hour

01/14/2021



Lane Group	EBL	EBT	WBT	WBR	NWL	NWT	NWR
Lane Group Flow (vph)	418	932	293	387	120	122	28
v/c Ratio	1.19	0.94	0.64	0.59	0.27	0.26	0.05
Control Delay	137.1	33.8	26.9	6.5	19.4	19.3	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	137.1	33.8	26.9	6.5	19.4	19.3	0.1
Queue Length 50th (ft)	~191	283	93	0	35	36	0
Queue Length 95th (ft)	#331	#514	163	57	75	76	0
Internal Link Dist (ft)		425	300			449	
Turn Bay Length (ft)	250			75	100		
Base Capacity (vph)	352	1022	489	678	445	462	595
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.19	0.91	0.60	0.57	0.27	0.26	0.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 Build Weekday Evening Peak Hour
01/14/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations			↑↑↑			↑↑		
Traffic Volume (vph)	0	0	2211	0	0	1131		
Future Volume (vph)	0	0	2211	0	0	1131		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.88		
Frt						0.850		
Flt Protected								
Satd. Flow (prot)	0	0	4776	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4776	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						1		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Peak Hour Factor	0.92	0.92	0.97	0.97	0.98	0.98		
Heavy Vehicles (%)	2%	2%	1%	0%	0%	1%		
Adj. Flow (vph)	0	0	2279	0	0	1154		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	2279	0	0	1154		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Left	Left	Right	Left	Right		
Median Width(ft)		0	0		0			
Link Offset(ft)		0	0		0			
Crosswalk Width(ft)		16	16		16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	15			9	15	30		
Number of Detectors			2			1		
Detector Template			Thru			Right		
Leading Detector (ft)			100			20		
Trailing Detector (ft)			0			0		
Detector 1 Position(ft)			0			0		
Detector 1 Size(ft)			6			20		
Detector 1 Type			Cl+Ex			Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)			0.0			0.0		
Detector 1 Queue (s)			0.0			0.0		
Detector 1 Delay (s)			0.0			0.0		
Detector 2 Position(ft)			94					
Detector 2 Size(ft)			6					
Detector 2 Type			Cl+Ex					
Detector 2 Channel								
Detector 2 Extend (s)			0.0					
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 Build Weekday Evening Peak Hour
01/14/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effect Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			1.08			0.95		
Control Delay			47.1			46.7		
Queue Delay			1.5			0.0		
Total Delay			48.7			46.7		
LOS			D			D		
Approach Delay			48.7		46.7			
Approach LOS			D		D			

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 48.0

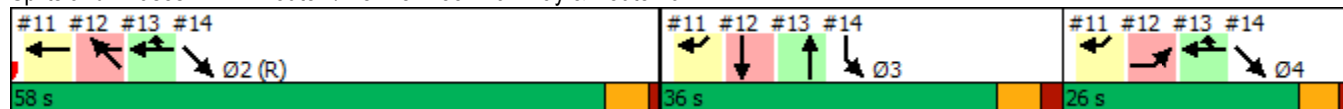
Intersection LOS: D

Intersection Capacity Utilization 100.6%

ICU Level of Service G

Analysis Period (min) 15

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16





Lane Group	WBT	SWR
Lane Group Flow (vph)	2279	1154
v/c Ratio	1.08	0.95
Control Delay	47.1	46.7
Queue Delay	1.5	0.0
Total Delay	48.7	46.7
Queue Length 50th (ft)	~704	472
Queue Length 95th (ft)	m#56	#644
Internal Link Dist (ft)	112	
Turn Bay Length (ft)		
Base Capacity (vph)	2109	1221
Starvation Cap Reductn	7	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.08	0.95

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

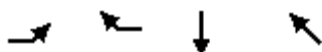
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

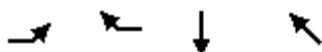
2027 Build Weekday Evening Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Lane Configurations	↰↰	↰	↕↕	↕↕
Traffic Volume (vph)	610	591	250	1620
Future Volume (vph)	610	591	250	1620
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Lane Util. Factor	0.97	1.00	0.95	0.95
Frt		0.865		
Flt Protected	0.950			
Satd. Flow (prot)	3257	1660	3291	3324
Flt Permitted	0.950			
Satd. Flow (perm)	3257	1660	3291	3324
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Peak Hour Factor	0.90	0.95	0.98	0.97
Heavy Vehicles (%)	0%	1%	2%	1%
Adj. Flow (vph)	678	622	255	1670
Shared Lane Traffic (%)				
Lane Group Flow (vph)	678	622	255	1670
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	R NA	Left	L NA
Median Width(ft)			0	0
Link Offset(ft)			0	0
Crosswalk Width(ft)			16	16
Two way Left Turn Lane				
Headway Factor	1.10	0.97	1.10	1.10
Turning Speed (mph)	15	30		
Number of Detectors	1	1	2	2
Detector Template	Left	Right	Thru	Thru
Leading Detector (ft)	20	20	100	100
Trailing Detector (ft)	0	0	0	0
Detector 1 Position(ft)	0	0	0	0
Detector 1 Size(ft)	20	20	6	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel				
Detector 1 Extend (s)	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0
Detector 2 Position(ft)			94	94
Detector 2 Size(ft)			6	6
Detector 2 Type			Cl+Ex	Cl+Ex
Detector 2 Channel				
Detector 2 Extend (s)			0.0	0.0
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

2027 Build Weekday Evening Peak Hour
01/14/2021



Lane Group	EBL	WBR	SBT	NWT
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effct Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	103.1
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	103.3
LOS	F	C	D	F
Approach Delay			37.8	103.3
Approach LOS			D	F

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 93.5

Intersection LOS: F

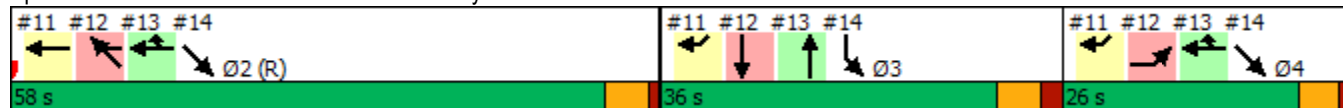
Intersection Capacity Utilization 134.8%

ICU Level of Service H

Analysis Period (min) 15

! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2

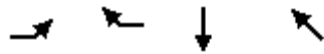


Queues

2027 Build Weekday Evening Peak Hour

01/14/2021

12: Alewife Brook Parkway & Route 2



Lane Group	EBL	WBR	SBT	NWT
Lane Group Flow (vph)	678	622	255	1670
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	103.1
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	103.3
Queue Length 50th (ft)	~326	422	84	~794
Queue Length 95th (ft)	#446	#639	123	#933
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	569	733	822	1468
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	53	0	107
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.19	0.91	0.31	1.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

















Queue shown is maximum after two cycles.

Lanes, Volumes, Timings

2027 Build Weekday Evening Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Future Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt						0.850						
Flt Protected												
Satd. Flow (prot)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Confl. Peds. (#/hr)						2						
Peak Hour Factor	0.92	0.92	0.92	0.95	0.95	0.95	0.97	0.97	0.97	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	0%	1%	1%	0%	1%	0%	2%	2%	2%
Adj. Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors					2	1		2				
Detector Template					Thru	Right		Thru				
Leading Detector (ft)					100	20		100				
Trailing Detector (ft)					0	0		0				
Detector 1 Position(ft)					0	0		0				
Detector 1 Size(ft)					6	20		6				
Detector 1 Type					Cl+Ex	Cl+Ex		Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)					0.0	0.0		0.0				
Detector 1 Queue (s)					0.0	0.0		0.0				
Detector 1 Delay (s)					0.0	0.0		0.0				
Detector 2 Position(ft)					94			94				
Detector 2 Size(ft)					6			6				
Detector 2 Type					Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0				

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Lane Util. Factor		
Ped Bike Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.56	0.36		0.30				
Control Delay					13.5	10.5		37.8				
Queue Delay					2.1	0.0		0.0				
Total Delay					15.6	10.5		37.8				
LOS					B	B		D				
Approach Delay					13.8			37.8				
Approach LOS					B			D				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 18.6

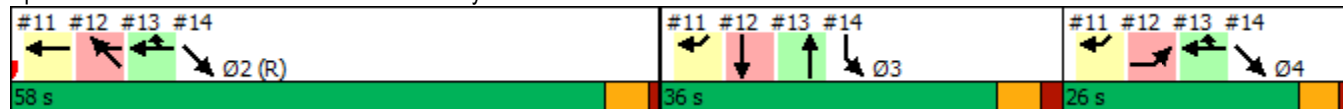
Intersection LOS: B

Intersection Capacity Utilization 52.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access



Lane Group	Ø2	Ø4
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effect Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Intersection Summary		

Queues

2027 Build Weekday Evening Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access











01/14/2021



Lane Group	WBT	WBR	NBT
Lane Group Flow (vph)	622	345	245
v/c Ratio	0.56	0.36	0.30
Control Delay	13.5	10.5	37.8
Queue Delay	2.1	0.0	0.0
Total Delay	15.6	10.5	37.8
Queue Length 50th (ft)	239	110	81
Queue Length 95th (ft)	337	165	119
Internal Link Dist (ft)	1145		147
Turn Bay Length (ft)		200	
Base Capacity (vph)	1114	947	804
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	337	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.80	0.36	0.30
Intersection Summary			

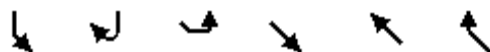
Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Evening Peak Hour
01/14/2021

								
Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations	 			 				
Traffic Volume (vph)	250	0	0	988	0	0		
Future Volume (vph)	250	0	0	988	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Lane Util. Factor	0.97	1.00	1.00	0.95	1.00	1.00		
Fr								
Flt Protected	0.950							
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	234							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Peak Hour Factor	0.98	0.98	0.90	0.90	0.92	0.92		
Heavy Vehicles (%)	2%	0%	0%	1%	2%	2%		
Adj. Flow (vph)	255	0	0	1098	0	0		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	255	0	0	1098	0	0		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	26			0	0			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10		
Turning Speed (mph)	30	9	15			9		
Number of Detectors	1			2				
Detector Template	Left			Thru				
Leading Detector (ft)	20			100				
Trailing Detector (ft)	0			0				
Detector 1 Position(ft)	0			0				
Detector 1 Size(ft)	20			6				
Detector 1 Type	Cl+Ex			Cl+Ex				
Detector 1 Channel								
Detector 1 Extend (s)	0.0			0.0				
Detector 1 Queue (s)	0.0			0.0				
Detector 1 Delay (s)	0.0			0.0				
Detector 2 Position(ft)				94				
Detector 2 Size(ft)				6				
Detector 2 Type				Cl+Ex				
Detector 2 Channel								
Detector 2 Extend (s)				0.0				
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Evening Peak Hour
01/14/2021



Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effect Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.26			0.50				
Control Delay	0.8			11.4				
Queue Delay	0.5			0.0				
Total Delay	1.3			11.4				
LOS	A			B				
Approach Delay	1.3			11.4				
Approach LOS	A			B				

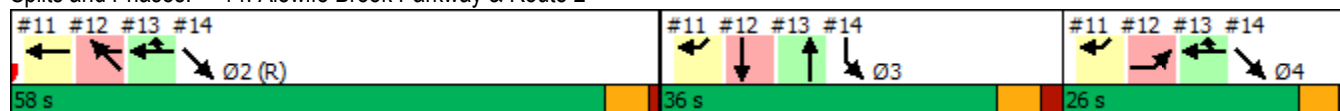
Intersection Summary

Area Type: CBD
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.19
Intersection Signal Delay: 9.5
Intersection Capacity Utilization 47.8%
Analysis Period (min) 15

Intersection LOS: A

ICU Level of Service A


Splits and Phases: 14: Alewife Brook Parkway & Route 2



Queues
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Evening Peak Hour

01/14/2021

















Lane Group	SBL	SET
Lane Group Flow (vph)	255	1098
v/c Ratio	0.26	0.50
Control Delay	0.8	11.4
Queue Delay	0.5	0.0
Total Delay	1.3	11.4
Queue Length 50th (ft)	0	210
Queue Length 95th (ft)	1	258
Internal Link Dist (ft)	75	217
Turn Bay Length (ft)		
Base Capacity (vph)	973	2188
Starvation Cap Reductn	391	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.44	0.50
Intersection Summary		

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Evening Peak Hour












01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	857	0	0	660	0	0	0	0	0	0	0
Future Volume (vph)	0	857	0	0	660	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr t												
Flt Protected												
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Peak Hour Factor	0.84	0.84	0.84	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	0	1020	0	0	680	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1020	0	0	680	0	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.88	0.88	0.88	0.85	0.85	0.85	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2			2							
Detector Template		Thru			Thru							
Leading Detector (ft)		100			100							
Trailing Detector (ft)		0			0							
Detector 1 Position(ft)		0			0							
Detector 1 Size(ft)		6			6							
Detector 1 Type		Cl+Ex			Cl+Ex							
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0							
Detector 1 Queue (s)		0.0			0.0							
Detector 1 Delay (s)		0.0			0.0							
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Evening Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.73			0.47							
Control Delay		11.3			6.9							
Queue Delay		50.6			1.8							
Total Delay		61.8			8.6							
LOS		E			A							
Approach Delay		61.8			8.6							
Approach LOS		E			A							
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green												
Natural Cycle: 60												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.73												
Intersection Signal Delay: 40.6												
Intersection LOS: D												
Intersection Capacity Utilization 48.9%												
ICU Level of Service A												
Analysis Period (min) 15												

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	220
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Evening Peak Hour

















01/14/2021



Lane Group	EBT	WBT
Lane Group Flow (vph)	1020	680
v/c Ratio	0.73	0.47
Control Delay	11.3	6.9
Queue Delay	50.6	1.8
Total Delay	61.8	8.6
Queue Length 50th (ft)	233	230
Queue Length 95th (ft)	316	168
Internal Link Dist (ft)	55	135
Turn Bay Length (ft)		
Base Capacity (vph)	1390	1460
Starvation Cap Reductn	0	585
Spillback Cap Reductn	609	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	1.31	0.78
Intersection Summary		

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street













2027 Build Weekday Evening Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	705	70	6	537	1	15	5	7	0	5	108
Future Volume (vph)	82	705	70	6	537	1	15	5	7	0	5	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.989						0.966			0.871	
Flt Protected		0.995			0.999			0.973				
Satd. Flow (prot)	0	1994	0	0	1961	0	0	1786	0	0	1655	0
Flt Permitted		0.893			0.991			0.635				
Satd. Flow (perm)	0	1790	0	0	1946	0	0	1165	0	0	1655	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8						9			140	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.75	0.75	0.75	0.77	0.77	0.77
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	93	801	80	7	610	1	20	7	9	0	6	140
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	974	0	0	618	0	0	36	0	0	146	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	0.92	0.92	0.92	0.96	0.96	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	

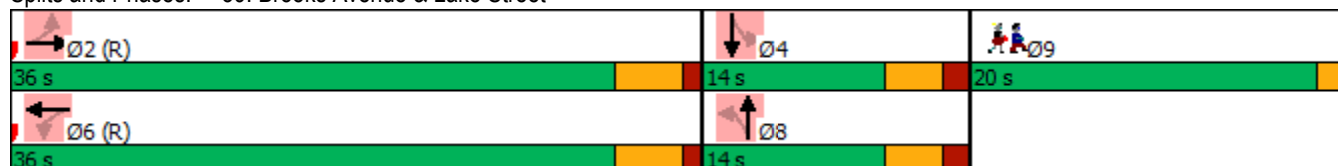
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 Build Weekday Evening Peak Hour
01/14/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		14.0	14.0		14.0	14.0	
Total Split (s)	36.0	36.0		36.0	36.0		14.0	14.0		14.0	14.0	
Total Split (%)	51.4%	51.4%		51.4%	51.4%		20.0%	20.0%		20.0%	20.0%	
Maximum Green (s)	31.5	31.5		31.5	31.5		9.5	9.5		9.5	9.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		Min	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		43.2			43.2			7.0			7.0	
Actuated g/C Ratio		0.62			0.62			0.10			0.10	
v/c Ratio		0.88			0.52			0.29			0.50	
Control Delay		26.9			12.3			29.2			12.8	
Queue Delay		47.7			0.6			0.0			0.2	
Total Delay		74.6			12.9			29.2			13.0	
LOS		E			B			C			B	
Approach Delay		74.6			12.9			29.2			13.0	
Approach LOS		E			B			C			B	
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.88												
Intersection Signal Delay: 47.1												
Intersection LOS: D												
Intersection Capacity Utilization 94.0%												
ICU Level of Service F												
Analysis Period (min) 15												

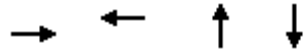
Splits and Phases: 39: Brooks Avenue & Lake Street



Lane Group	Ø9
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	42
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues
39: Brooks Avenue & Lake Street




2027 Build Weekday Evening Peak Hour
01/14/2021



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	974	618	36	146
v/c Ratio	0.88	0.52	0.29	0.50
Control Delay	26.9	12.3	29.2	12.8
Queue Delay	47.7	0.6	0.0	0.2
Total Delay	74.6	12.9	29.2	13.0
Queue Length 50th (ft)	~281	174	11	2
Queue Length 95th (ft)	#678	289	29	33
Internal Link Dist (ft)	135	1046	126	128
Turn Bay Length (ft)				
Base Capacity (vph)	1107	1200	165	345
Starvation Cap Reductn	247	0	0	0
Spillback Cap Reductn	0	254	0	18
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.13	0.65	0.22	0.45

Intersection Summary




- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.




Intersection						
Int Delay, s/veh	0.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	844	3	1	610	9	4
Future Vol, veh/h	844	3	1	610	9	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	94	94	75	75
Heavy Vehicles, %	0	0	0	0	29	0
Mvmt Flow	1017	4	1	649	12	5

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1021
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	688
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	688
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	41.8
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	115	-	-	688	-
HCM Lane V/C Ratio	0.151	-	-	0.002	-
HCM Control Delay (s)	41.8	-	-	10.2	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-





Intersection						
Int Delay, s/veh	1.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	842	6	9	588	23	5
Future Vol, veh/h	842	6	9	588	23	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	968	7	10	661	31	7
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	975	0	1653	972
Stage 1	-	-	-	-	972	-
Stage 2	-	-	-	-	681	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	716	-	109	309
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	506	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	716	-	107	309
Mov Cap-2 Maneuver	-	-	-	-	107	-
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	495	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0.2		47.5	
HCM LOS	E					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	121	-	-	716	-	
HCM Lane V/C Ratio	0.309	-	-	0.014	-	
HCM Control Delay (s)	47.5	-	-	10.1	0	
HCM Lane LOS	E	-	-	B	A	
HCM 95th %tile Q(veh)	1.2	-	-	0	-	

Intersection						
Int Delay, s/veh	0.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	846	1	1	591	6	4
Future Vol, veh/h	846	1	1	591	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	972	1	1	664	8	5

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	973	0	1639
Stage 1	-	-	-	-	973
Stage 2	-	-	-	-	666
Critical Hdwy	-	-	4.1	-	6.4
Critical Hdwy Stg 1	-	-	-	-	5.4
Critical Hdwy Stg 2	-	-	-	-	5.4
Follow-up Hdwy	-	-	2.2	-	3.5
Pot Cap-1 Maneuver	-	-	717	-	112
Stage 1	-	-	-	-	370
Stage 2	-	-	-	-	515
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	717	-	112
Mov Cap-2 Maneuver	-	-	-	-	112
Stage 1	-	-	-	-	370
Stage 2	-	-	-	-	514

Approach	EB	WB	NB
HCM Control Delay, s	0	0	31.3
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	150	-	-	717	-
HCM Lane V/C Ratio	0.089	-	-	0.002	-
HCM Control Delay (s)	31.3	-	-	10	0
HCM Lane LOS	D	-	-	B	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

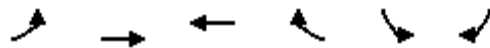
Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	827	19	11	578	8	13	1	6	3	0	1
Future Vol, veh/h	4	827	19	11	578	8	13	1	6	3	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	75	75	75	75	75	75
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	5	962	22	13	672	9	17	1	8	4	0	1
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	681	0	0	984	0	0	1686	1690	973	1691	1697	677
Stage 1	-	-	-	-	-	-	983	983	-	703	703	-
Stage 2	-	-	-	-	-	-	703	707	-	988	994	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	921	-	-	710	-	-	75	94	309	75	93	456
Stage 1	-	-	-	-	-	-	302	329	-	431	443	-
Stage 2	-	-	-	-	-	-	431	441	-	300	326	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	921	-	-	710	-	-	72	90	309	70	89	456
Mov Cap-2 Maneuver	-	-	-	-	-	-	72	90	-	70	89	-
Stage 1	-	-	-	-	-	-	298	325	-	426	430	-
Stage 2	-	-	-	-	-	-	417	428	-	288	322	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.2			57.1			48		
HCM LOS							F			E		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	95	921	-	-	710	-	-	89				
HCM Lane V/C Ratio	0.281	0.005	-	-	0.018	-	-	0.06				
HCM Control Delay (s)	57.1	8.9	0	-	10.2	0	-	48				
HCM Lane LOS	F	A	A	-	B	A	-	E				
HCM 95th %tile Q(veh)	1	0	-	-	0.1	-	-	0.2				

Intersection												
Int Delay, s/veh	10											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	19	800	17	67	577	16	9	0	48	9	0	11
Future Vol, veh/h	19	800	17	67	577	16	9	0	48	9	0	11
Conflicting Peds, #/hr	0	0	0	304	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	88	88	88	81	81	81	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	23	964	20	76	656	18	11	0	59	11	0	14
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	674	0	0	1288	0	0	2148	2150	1278	1867	2151	665
Stage 1	-	-	-	-	-	-	1324	1324	-	817	817	-
Stage 2	-	-	-	-	-	-	824	826	-	1050	1334	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	927	-	-	545	-	-	35	49	205	56	49	464
Stage 1	-	-	-	-	-	-	194	227	-	373	393	-
Stage 2	-	-	-	-	-	-	370	389	-	277	225	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	927	-	-	407	-	-	19	24	153	25	24	464
Mov Cap-2 Maneuver	-	-	-	-	-	-	19	24	-	25	24	-
Stage 1	-	-	-	-	-	-	137	160	-	352	275	-
Stage 2	-	-	-	-	-	-	252	273	-	160	159	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			1.6			198.3			126.6		
HCM LOS							F			F		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	72	927	-	-	407	-	-	52				
HCM Lane V/C Ratio	0.977	0.025	-	-	0.187	-	-	0.481				
HCM Control Delay (s)	198.3	9	0	-	15.9	0	-	126.6				
HCM Lane LOS	F	A	A	-	C	A	-	F				
HCM 95th %tile Q(veh)	5	0.1	-	-	0.7	-	-	1.8				

HCM Unsignalized Intersection Capacity Analysis 17: Site Driveway/Dorothy Road & Littlejohn Street

2027 Build Weekday Evening Peak Hour

01/04/2021



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	
Traffic Volume (veh/h)	8	5	20	20	15	0
Future Volume (Veh/h)	8	5	20	20	15	0
Sign Control		Stop	Stop		Free	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	5	22	22	16	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	65	32	32	0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	65	32	32	0	0	
tC, single (s)	7.1	6.5	6.5	6.2	4.1	
tC, 2 stage (s)						
tF (s)	3.5	4.0	4.0	3.3	2.2	
p0 queue free %	99	99	97	98	99	
cM capacity (veh/h)	890	856	856	1091	1636	
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	14	44	16			
Volume Left	9	0	16			
Volume Right	0	22	0			
cSH	878	959	1636			
Volume to Capacity	0.02	0.05	0.01			
Queue Length 95th (ft)	1	4	1			
Control Delay (s)	9.2	8.9	7.2			
Lane LOS	A	A	A			
Approach Delay (s)	9.2	8.9	7.2			
Approach LOS	A	A				
Intersection Summary						
Average Delay			8.6			
Intersection Capacity Utilization			17.4%	ICU Level of Service		A
Analysis Period (min)			15			

2027 Build Weekday Morning Peak Hour Current Program



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	261	295	851	609	404	454	
Future Volume (vph)	261	295	851	609	404	454	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Grade (%)	0%		0%			0%	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Right Turn on Red		Yes		Yes			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Lane Group Flow (vph)	287	324	925	662	439	493	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Maximum Green (s)	22.0	22.0	31.0	31.0	9.0	46.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	None	None	Max	Max	None	Max	None
Walk Time (s)							5.0
Flash Dont Walk (s)							11.0
Pedestrian Calls (#/hr)							35
Act Effect Green (s)	17.2	17.2	31.8	31.8	48.2	47.2	
Actuated g/C Ratio	0.19	0.19	0.36	0.36	0.54	0.53	
v/c Ratio	0.73	0.59	0.76	0.99	1.50	0.50	
Control Delay	46.7	14.3	32.8	55.6	263.2	18.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	46.7	14.3	32.8	55.6	263.2	18.7	
LOS	D	B	C	E	F	B	
Approach Delay	29.5		42.3			133.9	
Approach LOS	C		D			F	
Queue Length 50th (ft)	170	42	282	~364	~341	214	
Queue Length 95th (ft)	259	125	#409	#606	#555	332	



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Internal Link Dist (ft)	1046		560			565	
Turn Bay Length (ft)		100		55	150		
Base Capacity (vph)	514	642	1224	669	292	989	
Starvation Cap Reductn	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	
Reduced v/c Ratio	0.56	0.50	0.76	0.99	1.50	0.50	

Intersection Summary

Area Type: Other

Cycle Length: 105

Actuated Cycle Length: 88.9

Natural Cycle: 120

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.50

Intersection Signal Delay: 67.1

Intersection LOS: E

Intersection Capacity Utilization 77.0%

ICU Level of Service D

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.














Splits and Phases: 2: Massachusetts Aevnue/Massachusetts Avenue & Lake Street

Ø2 53 s		Ø4 29 s		Ø9 23 s	
Ø5 15 s	Ø6 38 s				

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Morning Peak Hour

07/26/2021

							
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	312	493	211	421	271	221	525
Future Volume (vph)	312	493	211	421	271	221	525
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Grade (%)	0%			0%		0%	
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Right Turn on Red		Yes					Yes
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Lane Group Flow (vph)	343	542	251	501	0	541	577
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Maximum Green (s)	69.0		20.0	94.0	16.0	16.0	16.0
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0		3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0		0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0		0.0	0.0	0.0	0.0	0.0
Recall Mode	None		None	None	Max	Max	Max
Walk Time (s)	5.0			5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0	0
Act Effect Green (s)	15.8	63.4	16.3	37.2		16.1	16.1
Actuated g/C Ratio	0.25	1.00	0.26	0.59		0.25	0.25
v/c Ratio	0.65	0.30	0.58	0.25		1.04	0.78
Control Delay	27.8	0.4	27.3	6.5		79.8	17.1
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	27.8	0.4	27.3	6.5		79.8	17.1
LOS	C	A	C	A		E	B
Approach Delay	11.0			13.4		47.4	
Approach LOS	B			B		D	
Queue Length 50th (ft)	119	0	83	43		~235	55
Queue Length 95th (ft)	205	0	151	57		#482	#247

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Morning Peak Hour

07/26/2021

	→	↘	↙	←	↖	↗	↘
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Internal Link Dist (ft)	159			425		307	
Turn Bay Length (ft)		150	110				
Base Capacity (vph)	2110	1812	536	3455		519	737
Starvation Cap Reductn	0	0	0	0		0	0
Spillback Cap Reductn	0	0	0	0		0	0
Storage Cap Reductn	0	0	0	0		0	0
Reduced v/c Ratio	0.16	0.30	0.47	0.15		1.04	0.78

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 63.4

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.04

Intersection Signal Delay: 26.5

Intersection LOS: C

Intersection Capacity Utilization 67.9%

ICU Level of Service C

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.




















Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street

↖ Ø2	↘ Ø3	→ Ø4
21 s	25 s	74 s
	← Ø8	
	99 s	

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 Build Weekday Morning Peak Hour













07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	224	613	0	0	481	725	0	0	0	151	6	11
Future Volume (vph)	224	613	0	0	481	725	0	0	0	151	6	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Lane Group Flow (vph)	255	697	0	0	523	788	0	0	0	97	96	14
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Maximum Green (s)	11.5	32.0			16.0	16.0				16.0	16.0	16.0
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Vehicle Extension (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0			3.0	3.0				3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Recall Mode	None	None			None	None				Max	Max	Max
Walk Time (s)		5.0			5.0	5.0				5.0	5.0	5.0
Flash Dont Walk (s)		11.0			11.0	11.0				11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0				0	0	0
Act Effct Green (s)	11.0	31.5			16.0	16.0				16.0	16.0	16.0
Actuated g/C Ratio	0.18	0.53			0.27	0.27				0.27	0.27	0.27
v/c Ratio	0.77	0.70			1.06	1.04				0.23	0.22	0.02
Control Delay	40.9	15.2			83.1	54.3				19.0	18.9	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	40.9	15.2			83.1	54.3				19.0	18.9	0.1
LOS	D	B			F	D				B	B	A
Approach Delay		22.1			65.8						17.7	
Approach LOS		C			E						B	
Queue Length 50th (ft)	88	169			~217	~168				28	28	0
Queue Length 95th (ft)	#179	269			#380	#364				56	55	0

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 Build Weekday Morning Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Internal Link Dist (ft)		425			300			379			449	
Turn Bay Length (ft)	250					75				100		
Base Capacity (vph)	348	1012			494	761				425	429	591
Starvation Cap Reductn	0	0			0	0				0	0	0
Spillback Cap Reductn	0	0			0	0				0	0	0
Storage Cap Reductn	0	0			0	0				0	0	0
Reduced v/c Ratio	0.73	0.69			1.06	1.04				0.23	0.22	0.02

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 59.5

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.06

Intersection Signal Delay: 44.9

Intersection LOS: D

Intersection Capacity Utilization 75.4%

ICU Level of Service D

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 Build Weekday Morning Peak Hour

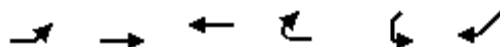
07/26/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations			↑↑↑			↑↑		
Traffic Volume (vph)	0	0	1597	0	0	1062		
Future Volume (vph)	0	0	1597	0	0	1062		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Grade (%)		0%	0%		0%			
Storage Length (ft)	0			0	0	0		
Storage Lanes	0			0	0	2		
Taper Length (ft)	25				25			
Right Turn on Red				Yes		Yes		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Lane Group Flow (vph)	0	0	1774	0	0	1249		
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Maximum Green (s)			53.0				30.0	21.0
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Vehicle Extension (s)			3.0				3.0	3.0
Minimum Gap (s)			3.0				3.0	3.0
Time Before Reduce (s)			0.0				0.0	0.0
Time To Reduce (s)			0.0				0.0	0.0
Recall Mode			C-Max				Max	Max
Walk Time (s)							5.0	
Flash Dont Walk (s)							8.0	
Pedestrian Calls (#/hr)							0	
Act Effct Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			0.85			1.02		
Control Delay			5.6			62.8		
Queue Delay			4.6			0.0		
Total Delay			10.1			62.8		
LOS			B			E		
Approach Delay			10.1		62.8			
Approach LOS			B		E			
Queue Length 50th (ft)			43			~581		
Queue Length 95th (ft)			m40			#659		

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 Build Weekday Morning Peak Hour
07/26/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Internal Link Dist (ft)		121	112		216			
Turn Bay Length (ft)								
Base Capacity (vph)			2088			1225		
Starvation Cap Reductn			252			0		
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			0.97			1.02		

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 31.9

Intersection LOS: C

Intersection Capacity Utilization 84.7%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

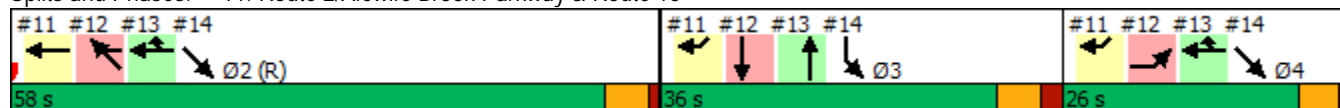
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour

07/26/2021

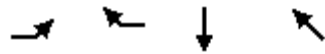


Lane Group	EBL	WBR	SBT	NWT
Lane Configurations	↔↔	↔	↕↕	↕↕
Traffic Volume (vph)	505	169	506	1428
Future Volume (vph)	505	169	506	1428
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Grade (%)			0%	0%
Storage Length (ft)	0	0		
Storage Lanes	2	1		
Taper Length (ft)	25			
Right Turn on Red				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Lane Group Flow (vph)	521	180	595	1587
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Maximum Green (s)	21.0	53.0	30.0	53.0
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0
Recall Mode	Max	C-Max	Max	C-Max
Walk Time (s)			5.0	
Flash Dont Walk (s)			8.0	
Pedestrian Calls (#/hr)			0	
Act Effect Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	0.92	0.26	0.72	1.09
Control Delay	72.2	14.3	47.1	85.8
Queue Delay	0.0	2.4	0.0	3.3
Total Delay	72.2	16.7	47.1	89.1
LOS	E	B	D	F
Approach Delay			47.1	89.1
Approach LOS			D	F
Queue Length 50th (ft)	206	86	223	~730
Queue Length 95th (ft)	#308	138	269	#868

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour

07/26/2021



Lane Group	EBL	WBR	SBT	NWT
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	564	698	822	1453
Starvation Cap Reductn	0	397	0	0
Spillback Cap Reductn	0	6	0	13
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.92	0.60	0.72	1.10

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 72.8

Intersection LOS: E

Intersection Capacity Utilization 103.7%

ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

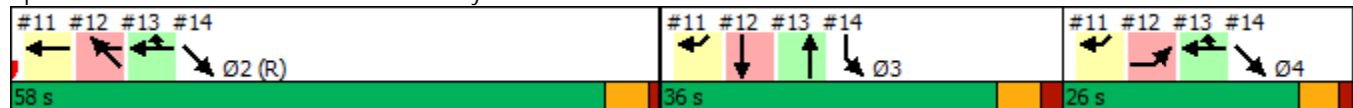
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2



















Lanes, Volumes, Timings

2027 Build Weekday Morning Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Future Volume (vph)	0	0	0	0	169	54	0	224	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			No			No	No		No			No
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Lane Group Flow (vph)	0	0	0	0	184	59	0	249	0	0	0	0
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Maximum Green (s)								30.0				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0				
Minimum Gap (s)								3.0				
Time Before Reduce (s)								0.0				
Time To Reduce (s)								0.0				
Recall Mode								Max				
Walk Time (s)								5.0				
Flash Dont Walk (s)								8.0				
Pedestrian Calls (#/hr)								0				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.17	0.07		0.32				
Control Delay					8.4	7.6		38.0				
Queue Delay					0.1	0.0		0.0				
Total Delay					8.5	7.6		38.0				
LOS					A	A		D				
Approach Delay					8.3			38.0				
Approach LOS					A			D				
Queue Length 50th (ft)					50	15		83				
Queue Length 95th (ft)					81	31		121				

Lanes, Volumes, Timings
13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

2027 Build Weekday Morning Peak Hour

07/26/2021

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Right Turn on Red		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Maximum Green (s)	53.0	21.0
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Minimum Gap (s)	3.0	3.0
Time Before Reduce (s)	0.0	0.0
Time To Reduce (s)	0.0	0.0
Recall Mode	C-Max	Max
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		

Lanes, Volumes, Timings

2027 Build Weekday Morning Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

07/26/2021

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group												
Internal Link Dist (ft)		81			1145			147			105	
Turn Bay Length (ft)						200						
Base Capacity (vph)					1061	877		788				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					223	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.22	0.07		0.32				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 23.3

Intersection LOS: C

Intersection Capacity Utilization 27.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access









#11	#12	#13	#14	#11	#12	#13	#14	#11	#12	#13	#14
←	↖	↗	↘	←	↓	↑	↘	←	↖	↗	↘
Ø2 (R)				Ø3				Ø4			
58 s				36 s				26 s			

Lane Group	Ø2	Ø4
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		
Intersection Summary		

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour

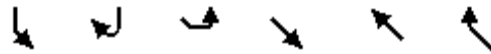
07/26/2021

								
Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations								
Traffic Volume (vph)	506	0	0	1103	0	0		
Future Volume (vph)	506	0	0	1103	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Grade (%)	0%			0%	0%			
Storage Length (ft)	0	0	0			0		
Storage Lanes	2	0	0			0		
Taper Length (ft)	25		25					
Right Turn on Red	Yes	Yes				Yes		
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Lane Group Flow (vph)	595	0	0	1137	0	0		
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Maximum Green (s)	30.0						53.0	21.0
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0						3.0	3.0
Minimum Gap (s)	3.0						3.0	3.0
Time Before Reduce (s)	0.0						0.0	0.0
Time To Reduce (s)	0.0						0.0	0.0
Recall Mode	Max						C-Max	Max
Walk Time (s)	5.0							
Flash Dont Walk (s)	8.0							
Pedestrian Calls (#/hr)	0							
Act Effect Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.62			0.52				
Control Delay	2.8			11.7				
Queue Delay	1.0			0.0				
Total Delay	3.7			11.7				
LOS	A			B				
Approach Delay	3.7			11.7				
Approach LOS	A			B				
Queue Length 50th (ft)	5			221				
Queue Length 95th (ft)	0			272				

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Morning Peak Hour

07/26/2021



Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Internal Link Dist (ft)	75			217	59			
Turn Bay Length (ft)								
Base Capacity (vph)	959			2188				
Starvation Cap Reductn	155			0				
Spillback Cap Reductn	0			0				
Storage Cap Reductn	0			0				
Reduced v/c Ratio	0.74			0.52				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.09

Intersection Signal Delay: 9.0

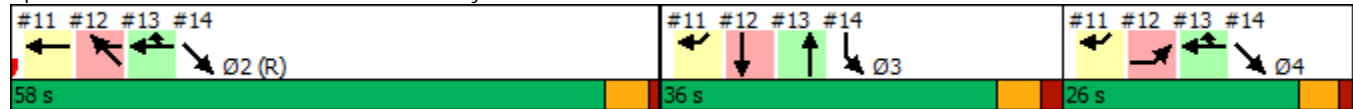
Intersection LOS: A

Intersection Capacity Utilization 59.1%

ICU Level of Service B

Analysis Period (min) 15















Splits and Phases: 14: Alewife Brook Parkway & Route 2



Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Morning Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	625	0	0	1166	0	0	0	0	0	0	0
Future Volume (vph)	0	625	0	0	1166	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Lane Group Flow (vph)	0	744	0	0	1202	0	0	0	0	0	0	0
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Maximum Green (s)		42.5			42.5							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0							
Minimum Gap (s)		3.0			3.0							
Time Before Reduce (s)		0.0			0.0							
Time To Reduce (s)		0.0			0.0							
Recall Mode		C-Max			C-Max							
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.54			0.82							
Control Delay		7.4			17.3							
Queue Delay		53.2			50.3							
Total Delay		60.6			67.7							
LOS		E			E							
Approach Delay		60.6			67.7							
Approach LOS		E			E							
Queue Length 50th (ft)		134			571							
Queue Length 95th (ft)		182			m580							

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Morning Peak Hour













07/26/2021

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Right Turn on Red	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Maximum Green (s)	21.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Minimum Gap (s)	3.0
Time Before Reduce (s)	0.0
Time To Reduce (s)	0.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	311
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Morning Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		55			135			95			126	
Turn Bay Length (ft)												
Base Capacity (vph)		1390			1460							
Starvation Cap Reductn		0			729							
Spillback Cap Reductn		812			0							
Storage Cap Reductn		0			0							
Reduced v/c Ratio		1.29			1.64							

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 65.0

Intersection LOS: E



Intersection Capacity Utilization 65.1%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street

















 Ø2 (R)	 Ø9
47 s	23 s
 Ø6 (R)	
47 s	

Lane Group	Ø9
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 Build Weekday Morning Peak Hour

07/26/2021













												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	548	46	6	1007	0	38	4	5	3	7	121
Future Volume (vph)	31	548	46	6	1007	0	38	4	5	3	7	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		215			1126			206			208	
Travel Time (s)		4.9			25.6			4.7			4.7	
Lane Group Flow (vph)	0	687	0	0	1164	0	0	63	0	0	168	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		2			6		3	8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		3	8		4	4	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		8.5	14.0		13.0	13.0	
Total Split (s)	27.0	27.0		27.0	27.0		10.0	23.0		13.0	13.0	
Total Split (%)	38.6%	38.6%		38.6%	38.6%		14.3%	32.9%		18.6%	18.6%	
Maximum Green (s)	22.5	22.5		22.5	22.5		5.5	18.5		8.5	8.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		4.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		0.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	Min		Min	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		40.9			40.9			9.3			9.3	
Actuated g/C Ratio		0.58			0.58			0.13			0.13	
v/c Ratio		0.64			1.03			0.50			0.48	
Control Delay		23.5			56.8			38.1			10.7	
Queue Delay		33.2			30.2			0.0			0.4	
Total Delay		56.7			87.0			38.1			11.2	
LOS		E			F			D			B	
Approach Delay		56.7			87.0			38.1			11.2	
Approach LOS		E			F			D			B	
Queue Length 50th (ft)		249			-637			23			5	
Queue Length 95th (ft)		#448			#879			44			35	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Right Turn on Red	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Maximum Green (s)	18.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Minimum Gap (s)	3.0
Time Before Reduce (s)	0.0
Time To Reduce (s)	0.0
Recall Mode	None
Walk Time (s)	5.0
Flash Dont Walk (s)	11.0
Pedestrian Calls (#/hr)	52
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 Build Weekday Morning Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		135			1046			126			128	
Turn Bay Length (ft)												
Base Capacity (vph)		1066			1132			245			372	
Starvation Cap Reductn		412			0			0			0	
Spillback Cap Reductn		0			480			1			38	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		1.05			1.79			0.26			0.50	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection

Natural Cycle: 110

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.03

Intersection Signal Delay: 69.4

Intersection LOS: E

Intersection Capacity Utilization 77.5%

ICU Level of Service D

Analysis Period (min) 15







~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.




95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 39: Brooks Avenue & Lake Street

 Ø2 (R)	 Ø3	 Ø4	 Ø9
27 s	10 s	13 s	20 s
 Ø5 (R)	 Ø8		
27 s	23 s		




Lane Group	Ø9
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Intersection						
Int Delay, s/veh	0.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	621	3	1	1201	5	1
Future Vol, veh/h	621	3	1	1201	5	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	87	87	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	828	4	1	1380	7	1

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	832
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	809
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	809
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	78.2
HCM LOS			F




Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	57	-	-	809	-
HCM Lane V/C Ratio	0.14	-	-	0.001	-
HCM Control Delay (s)	78.2	-	-	9.5	0
HCM Lane LOS	F	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection						
Int Delay, s/veh	4.5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	608	14	5	1166	36	6
Future Vol, veh/h	608	14	5	1166	36	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	811	19	5	1254	48	8
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	830	0	2085	821
Stage 1	-	-	-	-	821	-
Stage 2	-	-	-	-	1264	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	811	-	59	378
Stage 1	-	-	-	-	436	-
Stage 2	-	-	-	-	268	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	811	-	58	378
Mov Cap-2 Maneuver	-	-	-	-	58	-
Stage 1	-	-	-	-	436	-
Stage 2	-	-	-	-	263	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0		173.7	
HCM LOS	F					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	66	-	-	811	-	
HCM Lane V/C Ratio	0.848	-	-	0.007	-	
HCM Control Delay (s)	173.7	-	-	9.5	0	
HCM Lane LOS	F	-	-	A	A	
HCM 95th %tile Q(veh)	4	-	-	0	-	

HCM 6th TWSC
26: Homestead Road & Lake Street

2027 Build Weekday Morning Peak Hour

07/26/2021

Intersection						
Int Delay, s/veh	0.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	609	5	3	1164	7	1
Future Vol, veh/h	609	5	3	1164	7	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	93	93	75	75
Heavy Vehicles, %	2	0	0	1	0	0
Mvmt Flow	812	7	3	1252	9	1
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	819	0	2074	816
Stage 1	-	-	-	-	816	-
Stage 2	-	-	-	-	1258	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	818	-	60	380
Stage 1	-	-	-	-	438	-
Stage 2	-	-	-	-	270	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	818	-	59	380
Mov Cap-2 Maneuver	-	-	-	-	59	-
Stage 1	-	-	-	-	438	-
Stage 2	-	-	-	-	267	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0		69.8	
HCM LOS	F					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	66	-	-	818	-	
HCM Lane V/C Ratio	0.162	-	-	0.004	-	
HCM Control Delay (s)	69.8	-	-	9.4	0	
HCM Lane LOS	F	-	-	A	A	
HCM 95th %tile Q(veh)	0.5	-	-	0	-	

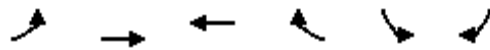
Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	592	18	8	1148	5	8	0	14	4	0	11
Future Vol, veh/h	0	592	18	8	1148	5	8	0	14	4	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	96	96	96	80	80	80	92	92	92
Heavy Vehicles, %	0	1	0	0	0	0	0	0	10	0	0	0
Mvmt Flow	0	749	23	8	1196	5	10	0	18	4	0	12
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1201	0	0	772	0	0	1982	1978	761	1985	1987	1199
Stage 1	-	-	-	-	-	-	761	761	-	1215	1215	-
Stage 2	-	-	-	-	-	-	1221	1217	-	770	772	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.3	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.39	3.5	4	3.3
Pot Cap-1 Maneuver	588	-	-	852	-	-	47	63	393	46	62	228
Stage 1	-	-	-	-	-	-	401	417	-	224	256	-
Stage 2	-	-	-	-	-	-	222	256	-	396	412	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	588	-	-	852	-	-	44	61	393	43	60	228
Mov Cap-2 Maneuver	-	-	-	-	-	-	44	61	-	43	60	-
Stage 1	-	-	-	-	-	-	401	417	-	224	249	-
Stage 2	-	-	-	-	-	-	204	249	-	378	412	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.1			53.5			45		
HCM LOS							F			E		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	101	588	-	-	852	-	-	106				
HCM Lane V/C Ratio	0.272	-	-	-	0.01	-	-	0.154				
HCM Control Delay (s)	53.5	0	-	-	9.3	0	-	45				
HCM Lane LOS	F	A	-	-	A	A	-	E				
HCM 95th %tile Q(veh)	1	0	-	-	0	-	-	0.5				




Intersection												
Int Delay, s/veh	5.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	3	593	14	27	1136	3	9	0	29	3	0	16
Future Vol, veh/h	3	593	14	27	1136	3	9	0	29	3	0	16
Conflicting Peds, #/hr	0	0	0	304	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	97	97	97	75	75	75	75	75	75
Heavy Vehicles, %	0	2	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	4	706	17	28	1171	3	12	0	39	4	0	21
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1174	0	0	1027	0	0	2266	2257	1019	1971	2264	1173
Stage 1	-	-	-	-	-	-	1027	1027	-	1229	1229	-
Stage 2	-	-	-	-	-	-	1239	1230	-	742	1035	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	602	-	-	684	-	-	29	42	290	47	41	236
Stage 1	-	-	-	-	-	-	285	314	-	220	252	-
Stage 2	-	-	-	-	-	-	217	252	-	411	312	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	602	-	-	511	-	-	17	26	217	34	26	236
Mov Cap-2 Maneuver	-	-	-	-	-	-	17	26	-	34	26	-
Stage 1	-	-	-	-	-	-	210	232	-	218	212	-
Stage 2	-	-	-	-	-	-	166	212	-	334	231	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.3			204.1			42.1		
HCM LOS							F			E		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	57	602	-	-	511	-	-	122				
HCM Lane V/C Ratio	0.889	0.006	-	-	0.054	-	-	0.208				
HCM Control Delay (s)	204.1	11	0	-	12.4	0	-	42.1				
HCM Lane LOS	F	B	A	-	B	A	-	E				
HCM 95th %tile Q(veh)	4	0	-	-	0.2	-	-	0.7				

HCM Unsignalized Intersection Capacity Analysis 17: Site Driveway/Dorothy Road & Littlejohn Street

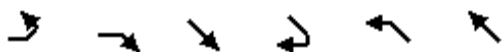
2027 Build Weekday Morning Peak Hour

07/26/2021



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	12	7	19	30	19	0
Future Volume (Veh/h)	12	7	19	30	19	0
Sign Control		Stop	Stop		Free	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	13	8	21	33	21	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	86	42	42	0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	86	42	42	0	0	
tC, single (s)	7.1	6.5	6.5	6.2	4.1	
tC, 2 stage (s)						
tF (s)	3.5	4.0	4.0	3.3	2.2	
p0 queue free %	98	99	98	97	99	
cM capacity (veh/h)	853	843	843	1091	1636	
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	21	54	21			
Volume Left	13	0	21			
Volume Right	0	33	0			
cSH	849	979	1636			
Volume to Capacity	0.02	0.06	0.01			
Queue Length 95th (ft)	2	4	1			
Control Delay (s)	9.3	8.9	7.2			
Lane LOS	A	A	A			
Approach Delay (s)	9.3	8.9	7.2			
Approach LOS	A	A				
Intersection Summary						
Average Delay			8.6			
Intersection Capacity Utilization			17.7%		ICU Level of Service	
Analysis Period (min)			15		A	

2027 Build Weekday Evening Peak Hour Current Program



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Lane Configurations							
Traffic Volume (vph)	432	280	658	192	352	739	
Future Volume (vph)	432	280	658	192	352	739	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	11	10	11	12	
Grade (%)	0%		0%			0%	
Storage Length (ft)	0	100		55	150		
Storage Lanes	1	1		1	1		
Taper Length (ft)	25				25		
Satd. Flow (prot)	2046	1830	3421	1507	1745	1863	
Flt Permitted	0.950				0.220		
Satd. Flow (perm)	2046	1830	3421	1507	404	1863	
Right Turn on Red		Yes		Yes			
Satd. Flow (RTOR)		140		87			
Link Speed (mph)	30		30			30	
Link Distance (ft)	1126		640			645	
Travel Time (s)	25.6		14.5			14.7	
Lane Group Flow (vph)	491	318	715	209	383	803	
Turn Type	Prot	Perm	NA	Perm	pm+pt	NA	
Protected Phases	4		6		5	2	9
Permitted Phases		4		6	2		
Detector Phase	4	4	6	6	5	2	
Switch Phase							
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	23.0	23.0	23.0	23.0	10.0	23.0	19.0
Total Split (s)	29.0	29.0	38.0	38.0	15.0	53.0	23.0
Total Split (%)	27.6%	27.6%	36.2%	36.2%	14.3%	50.5%	22%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	2.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	7.0	7.0	7.0	7.0	6.0	7.0	
Lead/Lag			Lag	Lag	Lead		
Lead-Lag Optimize?			Yes	Yes	Yes		
Recall Mode	None	None	Max	Max	None	Max	None
Act Effect Green (s)	22.2	22.2	31.3	31.3	47.5	46.5	
Actuated g/C Ratio	0.24	0.24	0.34	0.34	0.51	0.50	
v/c Ratio	1.01	0.59	0.62	0.37	1.14	0.87	
Control Delay	81.8	23.6	30.4	17.2	116.1	34.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	81.8	23.6	30.4	17.2	116.1	34.8	
LOS	F	C	C	B	F	C	
Approach Delay	58.9		27.4			61.1	
Approach LOS	E		C			E	
Queue Length 50th (ft)	~362	102	211	59	~224	480	
Queue Length 95th (ft)	#541	188	277	124	#433	#740	
Internal Link Dist (ft)	1046		560			565	
Turn Bay Length (ft)		100		55	150		
Base Capacity (vph)	486	542	1147	562	335	927	
Starvation Cap Reductn	0	0	0	0	0	0	



Lane Group	EBL	EBR	SET	SER	NWL	NWT	Ø9
Spillback Cap Reductn	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	
Reduced v/c Ratio	1.01	0.59	0.62	0.37	1.14	0.87	

Intersection Summary

Area Type: Other

Cycle Length: 105

Actuated Cycle Length: 93.4

Natural Cycle: 100

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.14

Intersection Signal Delay: 49.8

Intersection LOS: D

Intersection Capacity Utilization 78.3%

ICU Level of Service D

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.














Splits and Phases: 2: Massachusetts Avenue/Massachusetts Avenue & Lake Street

 53 s		 29 s		 23 s	
 15 s	 38 s				

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street








2027 Build Weekday Evening Peak Hour

07/26/2021

							
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Lane Configurations							
Traffic Volume (vph)	547	181	172	304	14	531	642
Future Volume (vph)	547	181	172	304	14	531	642
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	10	11	12	16	14
Grade (%)	0%			0%		0%	
Storage Length (ft)		150	110			0	0
Storage Lanes		1	1			1	1
Taper Length (ft)			25			25	
Satd. Flow (prot)	2153	1664	1652	3490	0	2046	1723
Flt Permitted			0.950			0.950	
Satd. Flow (perm)	2153	1664	1652	3490	0	2046	1723
Right Turn on Red		Yes					Yes
Satd. Flow (RTOR)		70					448
Link Speed (mph)	30			30		30	
Link Distance (ft)	239			505		387	
Travel Time (s)	5.4			11.5		8.8	
Lane Group Flow (vph)	582	193	198	349	0	568	669
Turn Type	NA	Free	Prot	NA	Perm	Prot	Perm
Protected Phases	4		3	8		2	
Permitted Phases		Free			2		2
Detector Phase	4		3	8	2	2	2
Switch Phase							
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0		9.0	21.0	21.0	21.0	21.0
Total Split (s)	74.0		25.0	99.0	21.0	21.0	21.0
Total Split (%)	61.7%		20.8%	82.5%	17.5%	17.5%	17.5%
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0		5.0	5.0		5.0	5.0
Lead/Lag	Lag		Lead				
Lead-Lag Optimize?	Yes		Yes				
Recall Mode	None		None	None	Max	Max	Max
Act Effect Green (s)	25.8	71.6	14.1	45.0		16.3	16.3
Actuated g/C Ratio	0.36	1.00	0.20	0.63		0.23	0.23
v/c Ratio	0.75	0.12	0.61	0.16		1.22	0.91
Control Delay	27.0	0.1	36.2	5.3		145.5	28.9
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	27.0	0.1	36.2	5.3		145.5	28.9
LOS	C	A	D	A		F	C
Approach Delay	20.3			16.5		82.4	
Approach LOS	C			B		F	
Queue Length 50th (ft)	216	0	80	28		~316	93
Queue Length 95th (ft)	362	0	157	40		#635	#370
Internal Link Dist (ft)	159			425		307	
Turn Bay Length (ft)		150	110				
Base Capacity (vph)	1999	1664	471	3490		467	739
Starvation Cap Reductn	0	0	0	0		0	0

Lanes, Volumes, Timings
5: Route 2 EB On/Off Ramps & Lake Street

2027 Build Weekday Evening Peak Hour
07/26/2021

							
Lane Group	EBT	EBR	WBL	WBT	NBU	NBL	NBR
Spillback Cap Reductn	0	0	0	0		0	0
Storage Cap Reductn	0	0	0	0		0	0
Reduced v/c Ratio	0.29	0.12	0.42	0.10		1.22	0.91

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 71.6

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.22

Intersection Signal Delay: 49.5

Intersection LOS: D

Intersection Capacity Utilization 81.0%

ICU Level of Service D

Analysis Period (min) 15

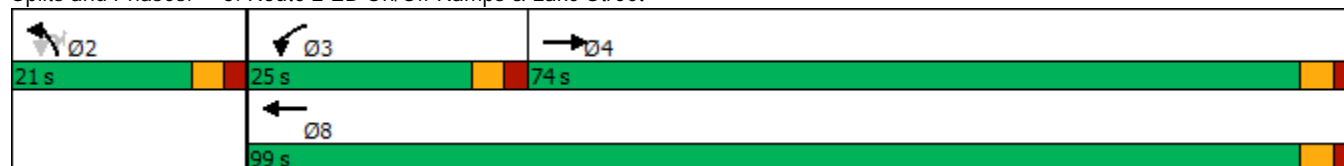
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.




















Splits and Phases: 5: Route 2 EB On/Off Ramps & Lake Street



Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street













2027 Build Weekday Evening Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	368	821	0	0	268	353	0	0	0	208	22	27
Future Volume (vph)	368	821	0	0	268	353	0	0	0	208	22	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	10	12	12	12	11	12	16
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	250		0	0		75	0		0	100		0
Storage Lanes	1		0	0		1	0		0	1		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Flt Permitted	0.950									0.950	0.961	
Satd. Flow (perm)	1805	1881	0	0	1801	1463	0	0	0	1641	1705	1830
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						388						136
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		505			380			459			529	
Travel Time (s)		11.5			8.6			10.4			12.0	
Lane Group Flow (vph)	418	933	0	0	295	388	0	0	0	120	122	28
Turn Type	Prot	NA			NA	Perm				Split	NA	Perm
Protected Phases	7	4			8					2	2	
Permitted Phases						8						2
Detector Phase	7	4			8	8				2	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
Minimum Split (s)	8.5	22.0			22.0	22.0				22.0	22.0	22.0
Total Split (s)	16.0	38.0			22.0	22.0				22.0	22.0	22.0
Total Split (%)	26.7%	63.3%			36.7%	36.7%				36.7%	36.7%	36.7%
Yellow Time (s)	4.0	4.0			4.0	4.0				4.0	4.0	4.0
All-Red Time (s)	0.5	2.0			2.0	2.0				2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Lost Time (s)	4.5	6.0			6.0	6.0				6.0	6.0	6.0
Lead/Lag	Lead				Lag	Lag						
Lead-Lag Optimize?	Yes				Yes	Yes						
Recall Mode	None	None			None	None				Max	Max	Max
Act Effct Green (s)	11.5	31.0			14.9	14.9				16.0	16.0	16.0
Actuated g/C Ratio	0.19	0.53			0.25	0.25				0.27	0.27	0.27
v/c Ratio	1.19	0.95			0.65	0.59				0.27	0.26	0.05
Control Delay	137.4	33.9			27.1	6.5				19.4	19.3	0.1
Queue Delay	0.0	0.0			0.0	0.0				0.0	0.0	0.0
Total Delay	137.4	33.9			27.1	6.5				19.4	19.3	0.1
LOS	F	C			C	A				B	B	A
Approach Delay		65.9			15.4						17.4	
Approach LOS		E			B						B	
Queue Length 50th (ft)	~191	283			93	0				35	36	0
Queue Length 95th (ft)	#331	#515			165	57				75	76	0
Internal Link Dist (ft)		425			300			379			449	
Turn Bay Length (ft)	250					75				100		
Base Capacity (vph)	351	1021			489	679				445	462	595
Starvation Cap Reductn	0	0			0	0				0	0	0

Lanes, Volumes, Timings
7: Route 2 WB Off Ramp & Lake Street

2027 Build Weekday Evening Peak Hour
07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Spillback Cap Reductn	0	0			0	0				0	0	0
Storage Cap Reductn	0	0			0	0				0	0	0
Reduced v/c Ratio	1.19	0.91			0.60	0.57				0.27	0.26	0.05

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 59

Natural Cycle: 65

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 45.2

Intersection LOS: D

Intersection Capacity Utilization 62.3%

ICU Level of Service B

Analysis Period (min) 15

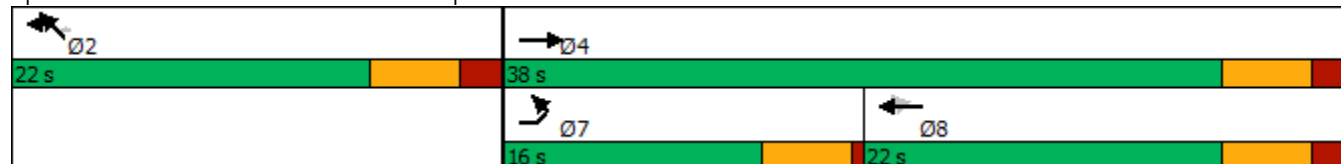
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 7: Route 2 WB Off Ramp & Lake Street



Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 Build Weekday Evening Peak Hour

07/26/2021

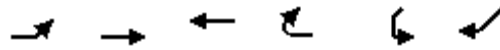


Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Lane Configurations			↑↑↑			↑↑		
Traffic Volume (vph)	0	0	2211	0	0	1131		
Future Volume (vph)	0	0	2211	0	0	1131		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Grade (%)		0%	0%		0%			
Storage Length (ft)	0			0	0	0		
Storage Lanes	0			0	0	2		
Taper Length (ft)	25				25			
Satd. Flow (prot)	0	0	4776	0	0	2617		
Flt Permitted								
Satd. Flow (perm)	0	0	4776	0	0	2617		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						1		
Link Speed (mph)		30	30		30			
Link Distance (ft)		201	192		296			
Travel Time (s)		4.6	4.4		6.7			
Lane Group Flow (vph)	0	0	2279	0	0	1154		
Turn Type			NA			custom		
Protected Phases			2			3 4	3	4
Permitted Phases								
Detector Phase			2			3 4		
Switch Phase								
Minimum Initial (s)			10.0				10.0	10.0
Minimum Split (s)			15.0				19.0	15.0
Total Split (s)			58.0				36.0	26.0
Total Split (%)			48.3%				30%	22%
Yellow Time (s)			4.0				4.0	3.5
All-Red Time (s)			1.0				2.0	1.5
Lost Time Adjust (s)			0.0					
Total Lost Time (s)			5.0					
Lead/Lag							Lead	Lag
Lead-Lag Optimize?								
Recall Mode			C-Max				Max	Max
Act Effect Green (s)			53.0			56.0		
Actuated g/C Ratio			0.44			0.47		
v/c Ratio			1.08			0.95		
Control Delay			47.1			46.7		
Queue Delay			1.5			0.0		
Total Delay			48.7			46.7		
LOS			D			D		
Approach Delay			48.7		46.7			
Approach LOS			D		D			
Queue Length 50th (ft)			~704			472		
Queue Length 95th (ft)			m#56			#644		
Internal Link Dist (ft)		121	112		216			
Turn Bay Length (ft)								
Base Capacity (vph)			2109			1221		
Starvation Cap Reductn			7			0		

Lanes, Volumes, Timings
11: Route 2/Alewife Brook Parkway & Route 16

2027 Build Weekday Evening Peak Hour

07/26/2021



Lane Group	EBL	EBT	WBT	WBR	SWL	SWR	Ø3	Ø4
Spillback Cap Reductn			0			0		
Storage Cap Reductn			0			0		
Reduced v/c Ratio			1.08			0.95		

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 48.0

Intersection LOS: D

Intersection Capacity Utilization 100.6%

ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

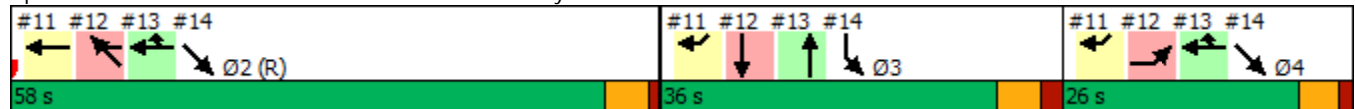
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

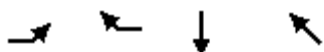
Splits and Phases: 11: Route 2/Alewife Brook Parkway & Route 16



Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

2027 Build Weekday Evening Peak Hour

07/26/2021

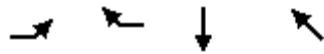


Lane Group	EBL	WBR	SBT	NWT
Lane Configurations	↔↔	↔	↕↕	↕↕
Traffic Volume (vph)	610	591	250	1620
Future Volume (vph)	610	591	250	1620
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	13	16	13	13
Grade (%)			0%	0%
Storage Length (ft)	0	0		
Storage Lanes	2	1		
Taper Length (ft)	25			
Satd. Flow (prot)	3257	1660	3291	3324
Flt Permitted	0.950			
Satd. Flow (perm)	3257	1660	3291	3324
Right Turn on Red				
Satd. Flow (RTOR)				
Link Speed (mph)			30	30
Link Distance (ft)			202	278
Travel Time (s)			4.6	6.3
Lane Group Flow (vph)	678	622	255	1670
Turn Type	Prot	Prot	NA	NA
Protected Phases	4	2!	3	2!
Permitted Phases				
Detector Phase	4	2	3	2
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	19.0	15.0
Total Split (s)	26.0	58.0	36.0	58.0
Total Split (%)	21.7%	48.3%	30.0%	48.3%
Yellow Time (s)	3.5	4.0	4.0	4.0
All-Red Time (s)	1.5	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	6.0	5.0
Lead/Lag	Lag		Lead	
Lead-Lag Optimize?				
Recall Mode	Max	C-Max	Max	C-Max
Act Effect Green (s)	21.0	53.0	30.0	53.0
Actuated g/C Ratio	0.18	0.44	0.25	0.44
v/c Ratio	1.19	0.85	0.31	1.14
Control Delay	145.7	29.8	37.8	103.1
Queue Delay	0.0	3.3	0.0	0.3
Total Delay	145.7	33.1	37.8	103.3
LOS	F	C	D	F
Approach Delay			37.8	103.3
Approach LOS			D	F
Queue Length 50th (ft)	~326	422	84	~794
Queue Length 95th (ft)	#446	#639	123	#933
Internal Link Dist (ft)			122	198
Turn Bay Length (ft)				
Base Capacity (vph)	569	733	822	1468
Starvation Cap Reductn	0	0	0	0

Lanes, Volumes, Timings
12: Alewife Brook Parkway & Route 2

2027 Build Weekday Evening Peak Hour

07/26/2021



Lane Group	EBL	WBR	SBT	NWT
Spillback Cap Reductn	0	53	0	107
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.19	0.91	0.31	1.23

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 93.5

Intersection LOS: F

Intersection Capacity Utilization 134.8%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

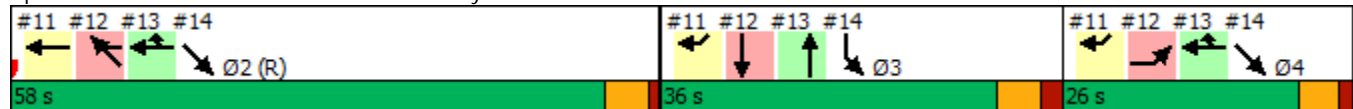
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

! Phase conflict between lane groups.

Splits and Phases: 12: Alewife Brook Parkway & Route 2




Lanes, Volumes, Timings

2027 Build Weekday Evening Peak Hour

13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

07/26/2021













												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑	↗		↑↑				
Traffic Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Future Volume (vph)	0	0	0	0	591	328	0	238	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		200	0		0	0		0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	1693	1439	0	3217	0	0	0	0
Right Turn on Red			No			No	No		No			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			1225			227			185	
Travel Time (s)		3.7			27.8			5.2			4.2	
Lane Group Flow (vph)	0	0	0	0	622	345	0	245	0	0	0	0
Turn Type					NA	Prot		NA				
Protected Phases					2 4	2 4		3				
Permitted Phases												
Detector Phase					2 4	2 4		3				
Switch Phase												
Minimum Initial (s)								10.0				
Minimum Split (s)								19.0				
Total Split (s)								36.0				
Total Split (%)								30.0%				
Yellow Time (s)								4.0				
All-Red Time (s)								2.0				
Lost Time Adjust (s)								0.0				
Total Lost Time (s)								6.0				
Lead/Lag								Lead				
Lead-Lag Optimize?												
Recall Mode								Max				
Act Effct Green (s)					79.0	79.0		30.0				
Actuated g/C Ratio					0.66	0.66		0.25				
v/c Ratio					0.56	0.36		0.30				
Control Delay					13.5	10.5		37.8				
Queue Delay					2.1	0.0		0.0				
Total Delay					15.6	10.5		37.8				
LOS					B	B		D				
Approach Delay					13.8			37.8				
Approach LOS					B			D				
Queue Length 50th (ft)					239	110		81				
Queue Length 95th (ft)					337	165		119				
Internal Link Dist (ft)		81			1145			147			105	
Turn Bay Length (ft)						200						
Base Capacity (vph)					1114	947		804				
Starvation Cap Reductn					0	0		0				

Lanes, Volumes, Timings
13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

2027 Build Weekday Evening Peak Hour

07/26/2021

Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	4
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	10.0	10.0
Minimum Split (s)	15.0	15.0
Total Split (s)	58.0	26.0
Total Split (%)	48%	22%
Yellow Time (s)	4.0	3.5
All-Red Time (s)	1.0	1.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		Lag
Lead-Lag Optimize?		
Recall Mode	C-Max	Max
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn					337	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.80	0.36		0.30				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 18.6

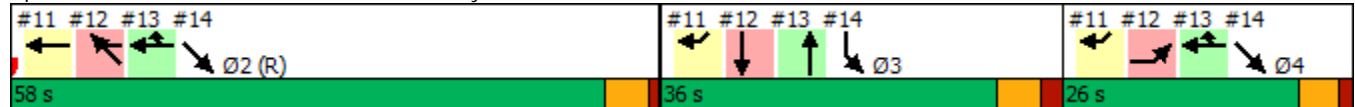
Intersection LOS: B

Intersection Capacity Utilization 52.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 13: Alewife Brook Parkway & Route 2/Rt 2 WB Access

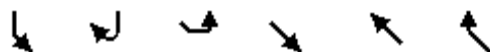


Lane Group	Ø2	Ø4
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		
Intersection Summary		

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Evening Peak Hour

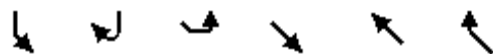
07/26/2021



Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Lane Configurations	↰↰			↱↱				
Traffic Volume (vph)	250	0	0	988	0	0		
Future Volume (vph)	250	0	0	988	0	0		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	13	13	13	13	13	13		
Grade (%)	0%			0%	0%			
Storage Length (ft)	0	0	0			0		
Storage Lanes	2	0	0			0		
Taper Length (ft)	25		25					
Satd. Flow (prot)	3193	0	0	3324	0	0		
Flt Permitted	0.950							
Satd. Flow (perm)	3193	0	0	3324	0	0		
Right Turn on Red	Yes	Yes				Yes		
Satd. Flow (RTOR)	234							
Link Speed (mph)	30			30	30			
Link Distance (ft)	155			297	139			
Travel Time (s)	3.5			6.8	3.2			
Lane Group Flow (vph)	255	0	0	1098	0	0		
Turn Type	Prot			NA				
Protected Phases	3			2 4			2	4
Permitted Phases								
Detector Phase	3			2 4				
Switch Phase								
Minimum Initial (s)	10.0						10.0	10.0
Minimum Split (s)	19.0						15.0	15.0
Total Split (s)	36.0						58.0	26.0
Total Split (%)	30.0%						48%	22%
Yellow Time (s)	4.0						4.0	3.5
All-Red Time (s)	2.0						1.0	1.5
Lost Time Adjust (s)	0.0							
Total Lost Time (s)	6.0							
Lead/Lag	Lead							Lag
Lead-Lag Optimize?								
Recall Mode	Max						C-Max	Max
Act Effect Green (s)	30.0			79.0				
Actuated g/C Ratio	0.25			0.66				
v/c Ratio	0.26			0.50				
Control Delay	0.8			11.4				
Queue Delay	0.5			0.0				
Total Delay	1.3			11.4				
LOS	A			B				
Approach Delay	1.3			11.4				
Approach LOS	A			B				
Queue Length 50th (ft)	0			210				
Queue Length 95th (ft)	1			258				
Internal Link Dist (ft)	75			217	59			
Turn Bay Length (ft)								
Base Capacity (vph)	973			2188				
Starvation Cap Reductn	391			0				

Lanes, Volumes, Timings
14: Alewife Brook Parkway & Route 2

2027 Build Weekday Evening Peak Hour
07/26/2021



Lane Group	SBL	SBR	SEL	SET	NWT	NWR	Ø2	Ø4
Spillback Cap Reductn	0			0				
Storage Cap Reductn	0			0				
Reduced v/c Ratio	0.44			0.50				

Intersection Summary

Area Type: CBD

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 16 (13%), Referenced to phase 2:WBT, Start of Green

Natural Cycle: 140

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 9.5

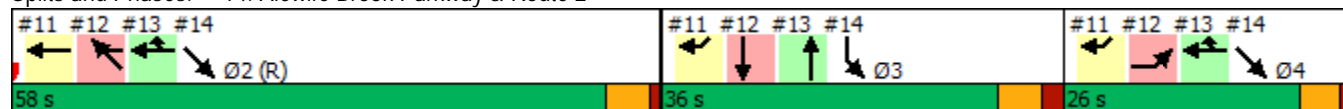
Intersection LOS: A

Intersection Capacity Utilization 47.8%

ICU Level of Service A

Analysis Period (min) 15















Splits and Phases: 14: Alewife Brook Parkway & Route 2



Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Evening Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	857	0	0	660	0	0	0	0	0	0	0
Future Volume (vph)	0	857	0	0	660	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	15	15	15	16	16	16	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2049	0	0	2153	0	0	0	0	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	2049	0	0	2153	0	0	0	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		135			215			175			206	
Travel Time (s)		3.1			4.9			4.0			4.7	
Lane Group Flow (vph)	0	1020	0	0	680	0	0	0	0	0	0	0
Turn Type		NA			NA							
Protected Phases		2			6							
Permitted Phases												
Detector Phase		2			6							
Switch Phase												
Minimum Initial (s)		4.0			4.0							
Minimum Split (s)		20.5			20.5							
Total Split (s)		47.0			47.0							
Total Split (%)		67.1%			67.1%							
Yellow Time (s)		3.5			3.5							
All-Red Time (s)		1.0			1.0							
Lost Time Adjust (s)		0.0			0.0							
Total Lost Time (s)		4.5			4.5							
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode		C-Max			C-Max							
Act Effct Green (s)		47.5			47.5							
Actuated g/C Ratio		0.68			0.68							
v/c Ratio		0.73			0.47							
Control Delay		11.3			6.9							
Queue Delay		50.6			1.8							
Total Delay		61.8			8.6							
LOS		E			A							
Approach Delay		61.8			8.6							
Approach LOS		E			A							
Queue Length 50th (ft)		233			230							
Queue Length 95th (ft)		316			168							
Internal Link Dist (ft)		55			135			95			126	
Turn Bay Length (ft)												
Base Capacity (vph)		1390			1460							
Starvation Cap Reductn		0			585							

Lanes, Volumes, Timings
36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Evening Peak Hour













07/26/2021

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	23.0
Total Split (%)	33%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	

Lanes, Volumes, Timings
 36: Minuteman Commuter Bikeway & Lake Street

2027 Build Weekday Evening Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn		609			0							
Storage Cap Reductn		0			0							
Reduced v/c Ratio		1.31			0.78							

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 16 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 40.6


Intersection LOS: D

Intersection Capacity Utilization 48.9%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 36: Minuteman Commuter Bikeway & Lake Street






 Ø2 (R)	 Ø9
47 s	23 s
 Ø6 (R)	
47 s	

Lane Group	Ø9
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 Build Weekday Evening Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	705	70	6	537	1	15	5	7	0	5	108
Future Volume (vph)	82	705	70	6	537	1	15	5	7	0	5	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	14	14	14	13	13	13	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1994	0	0	1961	0	0	1786	0	0	1655	0
Flt Permitted		0.893			0.991			0.635				
Satd. Flow (perm)	0	1790	0	0	1946	0	0	1165	0	0	1655	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8						9				140
Link Speed (mph)		30			30			30				30
Link Distance (ft)		215			1126			206				208
Travel Time (s)		4.9			25.6			4.7				4.7
Lane Group Flow (vph)	0	974	0	0	618	0	0	36	0	0	146	0
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		2			6			8				4
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.5	20.5		20.5	20.5		14.0	14.0		14.0	14.0	
Total Split (s)	36.0	36.0		36.0	36.0		14.0	14.0		14.0	14.0	
Total Split (%)	51.4%	51.4%		51.4%	51.4%		20.0%	20.0%		20.0%	20.0%	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.5	1.5		1.5	1.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Min	Min		Min	Min	
Act Effect Green (s)		43.2			43.2			7.0			7.0	
Actuated g/C Ratio		0.62			0.62			0.10			0.10	
v/c Ratio		0.88			0.52			0.29			0.50	
Control Delay		26.9			12.3			29.2			12.8	
Queue Delay		47.7			0.6			0.0			0.2	
Total Delay		74.6			12.9			29.2			13.0	
LOS		E			B			C			B	
Approach Delay		74.6			12.9			29.2			13.0	
Approach LOS		E			B			C			B	
Queue Length 50th (ft)		~281			174			11			2	
Queue Length 95th (ft)		#678			289			29			33	
Internal Link Dist (ft)		135			1046			126			128	
Turn Bay Length (ft)												
Base Capacity (vph)		1107			1200			165			345	
Starvation Cap Reductn		247			0			0			0	

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 Build Weekday Evening Peak Hour













07/26/2021

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	18.0
Total Split (s)	20.0
Total Split (%)	29%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	

Lanes, Volumes, Timings
39: Brooks Avenue & Lake Street

2027 Build Weekday Evening Peak Hour

07/26/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn		0			254			0			18	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		1.13			0.65			0.22			0.45	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green, Master Intersection

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 47.1

Intersection LOS: D

Intersection Capacity Utilization 94.0%

ICU Level of Service F

Analysis Period (min) 15






~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.




95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 39: Brooks Avenue & Lake Street

 Ø2 (R)	 Ø4	 Ø9
36 s	14 s	20 s
 Ø6 (R)	 Ø8	
36 s	14 s	




Lane Group	Ø9
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Intersection						
Int Delay, s/veh	0.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	845	3	1	612	9	4
Future Vol, veh/h	845	3	1	612	9	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	94	94	75	75
Heavy Vehicles, %	0	0	0	0	29	0
Mvmt Flow	1018	4	1	651	12	5

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1022
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	-
Pot Cap-1 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-




Approach	EB	WB	NB
HCM Control Delay, s	0	0	42.2
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	114	-	-	687	-
HCM Lane V/C Ratio	0.152	-	-	0.002	-
HCM Control Delay (s)	42.2	-	-	10.2	0
HCM Lane LOS	E	-	-	B	A
HCM 95th %tile Q(veh)	0.5	-	-	0	-

Intersection						
Int Delay, s/veh	1.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	843	6	9	588	25	5
Future Vol, veh/h	843	6	9	588	25	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	969	7	10	661	33	7
Major/Minor	Major1	Major2		Minor1		
Conflicting Flow All	0	0	976	0	1654	973
Stage 1	-	-	-	-	973	-
Stage 2	-	-	-	-	681	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	715	-	109	309
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	506	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	715	-	107	309
Mov Cap-2 Maneuver	-	-	-	-	107	-
Stage 1	-	-	-	-	370	-
Stage 2	-	-	-	-	495	-
Approach	EB	WB		NB		
HCM Control Delay, s	0	0.2		49.3		
HCM LOS	E					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	
Capacity (veh/h)	120	-	-	715	-	
HCM Lane V/C Ratio	0.333	-	-	0.014	-	
HCM Control Delay (s)	49.3	-	-	10.1	0	
HCM Lane LOS	E	-	-	B	A	
HCM 95th %tile Q(veh)	1.3	-	-	0	-	

HCM 6th TWSC
26: Homestead Road & Lake Street

2027 Build Weekday Evening Peak Hour
07/26/2021

Intersection						
Int Delay, s/veh	0.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	847	1	1	591	6	4
Future Vol, veh/h	847	1	1	591	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	89	89	75	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	974	1	1	664	8	5

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	975
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	716
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	716
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	31.5
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	149	-	-	716	-
HCM Lane V/C Ratio	0.089	-	-	0.002	-
HCM Control Delay (s)	31.5	-	-	10	0
HCM Lane LOS	D	-	-	B	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	4	828	19	11	578	8	13	1	6	3	0	1
Future Vol, veh/h	4	828	19	11	578	8	13	1	6	3	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	75	75	75	75	75	75
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	5	963	22	13	672	9	17	1	8	4	0	1
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	681	0	0	985	0	0	1687	1691	974	1692	1698	677
Stage 1	-	-	-	-	-	-	984	984	-	703	703	-
Stage 2	-	-	-	-	-	-	703	707	-	989	995	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	921	-	-	709	-	-	75	94	308	75	93	456
Stage 1	-	-	-	-	-	-	302	329	-	431	443	-
Stage 2	-	-	-	-	-	-	431	441	-	300	325	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	921	-	-	709	-	-	72	90	308	70	89	456
Mov Cap-2 Maneuver	-	-	-	-	-	-	72	90	-	70	89	-
Stage 1	-	-	-	-	-	-	298	325	-	426	430	-
Stage 2	-	-	-	-	-	-	417	428	-	288	321	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.2			57.1			48		
HCM LOS							F			E		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	95	921	-	-	709	-	-	89				
HCM Lane V/C Ratio	0.281	0.005	-	-	0.018	-	-	0.06				
HCM Control Delay (s)	57.1	8.9	0	-	10.2	0	-	48				
HCM Lane LOS	F	A	A	-	B	A	-	E				
HCM 95th %tile Q(veh)	1	0	-	-	0.1	-	-	0.2				

HCM 6th TWSC
33: Margaret Street/Lakehill Avenue & Lake Street

2027 Build Weekday Evening Peak Hour

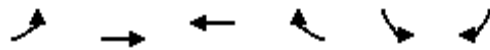
07/26/2021




Intersection												
Int Delay, s/veh	10											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	19	800	18	67	577	16	9	0	48	9	0	11
Future Vol, veh/h	19	800	18	67	577	16	9	0	48	9	0	11
Conflicting Peds, #/hr	0	0	0	304	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	88	88	88	81	81	81	80	80	80
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	23	964	22	76	656	18	11	0	59	11	0	14
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	674	0	0	1290	0	0	2149	2151	1279	1868	2153	665
Stage 1	-	-	-	-	-	-	1325	1325	-	817	817	-
Stage 2	-	-	-	-	-	-	824	826	-	1051	1336	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	927	-	-	544	-	-	35	49	205	56	49	464
Stage 1	-	-	-	-	-	-	194	227	-	373	393	-
Stage 2	-	-	-	-	-	-	370	389	-	277	224	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	927	-	-	406	-	-	19	24	153	25	24	464
Mov Cap-2 Maneuver	-	-	-	-	-	-	19	24	-	25	24	-
Stage 1	-	-	-	-	-	-	137	160	-	352	275	-
Stage 2	-	-	-	-	-	-	251	272	-	160	158	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			1.6			198.3			126.6		
HCM LOS							F			F		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	72	927	-	-	406	-	-	52				
HCM Lane V/C Ratio	0.977	0.025	-	-	0.188	-	-	0.481				
HCM Control Delay (s)	198.3	9	0	-	15.9	0	-	126.6				
HCM Lane LOS	F	A	A	-	C	A	-	F				
HCM 95th %tile Q(veh)	5	0.1	-	-	0.7	-	-	1.8				

HCM Unsignalized Intersection Capacity Analysis 17: Site Driveway/Dorothy Road & Littlejohn Street

2027 Build Weekday Evening Peak Hour

07/26/2021



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	5	21	20	15	0
Future Volume (Veh/h)	10	5	21	20	15	0
Sign Control		Stop	Stop		Free	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	5	23	22	16	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	66	32	32	0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	66	32	32	0	0	
tC, single (s)	7.1	6.5	6.5	6.2	4.1	
tC, 2 stage (s)						
tF (s)	3.5	4.0	4.0	3.3	2.2	
p0 queue free %	99	99	97	98	99	
cM capacity (veh/h)	889	856	856	1091	1636	
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	16	45	16			
Volume Left	11	0	16			
Volume Right	0	22	0			
cSH	878	957	1636			
Volume to Capacity	0.02	0.05	0.01			
Queue Length 95th (ft)	1	4	1			
Control Delay (s)	9.2	8.9	7.2			
Lane LOS	A	A	A			
Approach Delay (s)	9.2	8.9	7.2			
Approach LOS	A	A				
Intersection Summary						
Average Delay			8.6			
Intersection Capacity Utilization			17.5%		ICU Level of Service	
Analysis Period (min)			15		A	

MEMO

To: Arlington Zoning Board
Fr: Stephanie Kiefer, Esq.
Re: Thorndike Place
Date: August 3, 2021

As requested by the Board, the below is a summary of the proposed Thorndike Place 40B Project (the “Project”), as the concept design was most recently revised in May 2021 and updated in response to comments made within the Board’s last hearing on June 10, 2021.

THORNDIKE PLACE OVERVIEW

RESIDENTIAL COMPONENTS

The Project consists of two primary residential components: a) twelve (12) homeownership units as contained within six (6) duplex-style buildings and b) a 124-unit Independent Senior living residence (62+) with services, located in a four-story rental structure behind the duplex-style units. Each type of housing (the homeownership duplex units and the senior rental housing) will provide for 25% of the units be made available to low and moderate income families in accordance with the programmatic requirements of Chapter 40B; specifically three (3) of the duplex units will be affordable and 31 of the senior rental units will be affordable units subject to a Regulatory Agreement.

A. Duplex Units Overview

The twelve (12) duplex units, housed in six (6) structures are set back 20 feet along the Dorothy Road frontage. Except for the end duplex units (referenced as Duplex 1 and Duplex 12) to the west and the east, the balance of the single-family duplex homes will share a driveway with the neighboring duplex structure. The duplex unit design is consistent with and complimentary of the existing single-family and duplex-styles homes along Dorothy Road and/or otherwise in the neighborhood.

The duplex driveways are located between the duplex buildings, allowing each individual duplex unit to have a sizeable front yard directly in front of the housing structure. Excepting the end duplex units, Duplex 2 through Duplex 11 will have the ability to park two (2) cars in the shared driveways, with one car protected by a shared carport between the residential structures. The eastern- and western-most duplexes will have a side parking area, access by the main access drive (for the western-most duplex unit) and access by the site’s eastern emergency access drive for the eastern-most duplex unit).

The duplex structures will be 40 feet wide by 40 feet deep, and each duplex unit sized at 20 feet by 40 feet. The structures will have three (3) floors, with the total height of the buildings

being approximately 38+/- feet¹. Representative floor plans of Duplex “A” and Duplex “B” are provided within the updated set of architectural plans titled “Thorndike Place-Duplexes”, prepared by GreenStaxx and Bruce Hamilton Architects, dated July 26, 2021. The total habitable space for the duplex units is 1,981 square feet (Duplex “A” style) and 2,006 square feet (Duplex “B” style). As shown on the Thorndike Place Grading and Drainage Plan, Sheet C-105 of the BSC plan set, as revised through August 2, 2021, the first floor elevations of the duplex units will be at Elevation 12, well above the existing FEMA base flood elevation (6.8 NAVD 88) as well as the 500-year flood elevation (10.75 NAVD 88). The duplex units will include unfinished basements, for storage purposes only.

The four duplex structures closest to Littlejohn Street are not located within FEMA floodplain. Portions of the two easternmost duplex structures are located within the outer fringes of floodplain. As detailed in the BSC Group’s stormwater report, compensatory storage for any disturbed floodplain will be replicated to meet or exceed the 2:1 replication required under local regulation.

B. Independent Living Residential Building

Located behind the duplex units is the Thorndike Place age-restricted, independent living residential building. The structure includes garage parking on the lower level for 84 vehicles and four (4) stories of residential apartment units and community space for the senior residents, which is one floor below the allowable five-floors of residential use otherwise permitted in the PUD District. The first floor of the Independent Living building is at El. 16 with the garage level at approximately El. 6.

The main entrance to the residential structure is roughly at the midpoint of the building, and at the end of a cul-de-sac drive, to allow for easy pick up and drop off. The building is served by two sets of elevators: a) the main elevator which accesses the garage and all four floors residential floors located off the main entrance and b) a single floor elevator at the eastern end of the building, which provides access to the lower level common area room as well as into the parking garage. Delivery and trash pick up have a separate entrance point, located to the north of the main entry doors.

The building will include a total of 124 apartments, consisting of 43 studios, 58 one-bedroom and 23 two-bedroom units. In accordance with Chapter 40B, 25% of the independent living apartment units (31 units) will be made available to low- and moderate-income seniors. In addition to the individual apartment units, the interior of the building will include accessory uses to the senior living use such as reception/entry area, dining room, activities room, sitting areas and lounges, reading rooms, concierge desk, fitness room and areas for health checks with medical professionals, as well as a management office, commercial kitchen, trash room, laundry facilities, garage and covered bicycle parking.

¹ It is noted that the Property is located within the Planned Unit Development (“PUD”) zoning district; per the Zoning Bylaw, within the PUD District, buildings may be 85 feet in height and residential dwellings may be no higher than five (5) floors. The duplex units as well as the Independent Living building are well within the PUD permissible height limits.

The central portion of the four-story independent building will be set back 103' from the property's front lot line along Dorothy Road, which roughly translates to the length of a residential lot. The western tab of the building will be approximately 145' from the front lot line and the easternmost tab of the building will be approximately 171' from the front lot line.

The residents, who are anticipated to be mid-70s to 90s, will be provided with one evening meal. Additional services included with the independent living community are expected to include organized social and recreational events, fitness activities, coordination with area healthcare providers, concierge, handyman services, trash removal as well as optional laundry, housekeeping services and escort services². Likewise, the Independent Living residence will include a jitney services to make trips to public transportation, as well as in-town shopping, services and/or medical appointments. The jitney service likewise will be available to staff, to encourage use of public transportation.

PARKING

A. Duplex Parking

The duplex units will each have driveway and/or driveway/carport parking; each duplex unit will have parking space to accommodate two vehicles, with the exception of the eastern-most duplex which will have a single parking space.

B. Independent Living Parking (96 Parking Spaces)

The total of surface and garage parking spaces associated with the Independent Living residence is 96 spaces: 84 spaces are within the garage and 12 spaces are exterior parking spaces. While the four-story building is not an "assisted living" residence, it is noted that under the Zoning Bylaw, the number of parking spaces required for an assisted living residential use is calculated as .4 spaces per unit, or 50 spaces for a 124-unit residence. The ratio proposed at Thorndike Place is .77 spaces per unit, or 96 total spaces, which is consistent with the average parking under the ITE 5th Edition parking manual.

Within the garage, there are 84 parking spaces, of which eight (8) are handicapped spaces. Also, within the garage, there will be 10 electric vehicle charging stations, with the ability to expand as electric vehicles become more prevalent in the market. Garage parking will be secured by card, fob or similar entry methods. Parking will be a separate charge for residents, to discourage residents from bringing vehicles which will remain unused at the community. Garage parking will also be made available to staff and service providers.

² The operations of the Independent Living residence falls outside of the ZBA's jurisdiction, but is provided for informational purposes and context.

Surface parking is located in two areas. A western parking area, closest to the western gardens is designed to accommodate six (6) vehicles and another six (6) vehicle parking spaces are located along the southern entrance boulevard driveway which provides access to the main entrance to the Independent Living residence. Two (2) of those parking spaces will accommodate handicap parking.

C. Bicycle Parking – Independent Living

Along the northeast side of the Independent Living building is a covered, secured bike-parking storage area, sufficient to provide parking for 14 bicycles. The bicycle storage area will be accessed by a pathway extending from the eastern emergency access drive, to allow residents to readily park or pick-up their bikes without the need to enter into the building's garage. The number of bicycle parking spaces (14 spaces) exceeds the required number of bicycle spaces under the bicycle parking provisions of the applicable Zoning Bylaw, i.e., the bylaw in effect at the time of the 40B application submittal.

TRAFFIC DEMAND MITIGATION MEASURES

The Project includes the following measures to reduce single-occupancy trips and travel during peak traffic hours:

- a) Jitney service – as described above, the Independent Living will provide for a jitney service for residents, staff and service providers. The jitney can be set up on an “on demand” feature as well as scheduled pickups/returns to the Alewife T stop or area shopping destinations, as determined by onsite management to best address the needs of the residents, staff and providers.
- b) Scheduled deliveries/ trash & recycling haulers/staff and service provider hours/move-in
Scheduled deliveries, such as perishable goods (milk, eggs, meat and seafood) are expected to be delivered 2-3 times per week and will be scheduled outside of peak traffic hours. Similarly, trash/recycling pickup will be scheduled outside of peak traffic hours. Contract and/or service providers can also be scheduled within defined hours as set by management, to avoid travel during peak hours.
- c) Staffing - kitchen staffing necessarily arrives well before peak Lake Avenue traffic to prepare and provide dinners and leaves well after peak Lake Avenue traffic with completion of dinner clean up.
- d) Parking charge for residents – to discourage residents from parking unused cars as well as to encourage residents to make use of jitney/shared ride/public transportation services, there will be an extra charge for residents seeking to bring a vehicle with them to Thorndike Place.

- e) Exterior bike racks – while residents will have access to enclosed bicycle parking, guests, visitors or staff will have available exterior bicycle parking with stations outside the building's main entrance.
- f) ZipCar – depending on availability of an excess exterior parking space, Applicant agrees to approach ZipCar regarding the possibility of a car-share option onsite.

OUTDOOR AMENITIES

From the main access drive off Littlejohn Street, the driveway into Thorndike Place is a boulevard style drive, with trees lining either side of the access drive to provide a warm and welcoming approach to the building.

To the south and the west of the property, there will be outdoor passive recreational areas. Specifically, along the west side of the site west of the main access drive, the open areas will include garden areas, outdoor seating and possible games courts, such as bocce. A walkway extends along the edge between the garden areas and the access drive, which walkway extends to the south along the rear of the building and eventually to the eastern side of the building back to Dorothy Road.

Just past the access drive access point to the garage parking, the aforementioned walkway continues around the perimeter of the building, including passing by a vegetated courtyard on the backside of the residential building. The perimeter walk continues along the east side of the building, and out to Dorothy Road.

To the south of the perimeter walkway/emergency access road, the Applicant will retain a portion of the undeveloped area of the 17+ acre site to provide a woodland restoration area. The woodland area will provide for pleasing views from the rear of the Independent Living building and will also provide a private buffer for the residents

The balance of the undeveloped portion of the site, approximately 11.x acres and located to the south and to the east, will be conserved as open space to be held by a not-for-profit entity or the town. Under a separate Memorandum of Understanding, the applicant intends to work with the Town to establish a mutually agreeable framework for the open space parcel, to allow for the restoration of the wooded area and consideration of publicly accessible paths within the open space parcel.

THORNDIKE PLACE
List of Requested Waivers

As required under 760 CMR 56.05(2)(h), the following is a list of Waivers to “Local Requirements and Regulations,” including waivers from the Bylaws of the Town of Arlington (the “Bylaws”) , including the Town of Arlington Zoning Bylaw, as amended (the “Zoning Bylaw”), and other Local Requirements and Regulations as defined under 760 CMR 56.02 of the Chapter 40B Regulations, including all local legislative, regulatory, or other actions which are more restrictive than state requirements, if any, including local zoning and wetlands ordinances, subdivision and board of health rules, and other local ordinances, codes, and regulations, in each case which are in effect on the date of the Project’s application to the Board. In addition to the following list of requested Waivers below, the Applicant requests an exception from such provision or requirement of all Local Requirements and Regulations issued by a “Local Board” (defined under the Chapter 40B Regulations as means any local board or official, including, but not limited to any board of survey; board of health; planning board; conservation commission; historical commission; water, sewer, or other commission or district; fire, police, traffic, or other department; building inspector or similar official or board; city council, as well as all boards, regardless of their geographical jurisdiction or their source of authority [that is, including boards created by special acts of the legislature or by other legislative action] if such local board perform functions usually performed by locally created boards).

Pursuant to Chapter 40B rules described under 760 CMR 56.05(7), “[z]oning waivers are required solely from the “as-of-right” requirements of a zoning district where the project is located; there shall be no requirement to obtain waivers from the special permit requirements of the district.” Accordingly, any waivers which reference special permit requirements are included only for illustration purposes.

LIST OF WAIVERS/EXCEPTIONS

A. BY-LAWS OF THE TOWN OF ARLINGTON, MASSACHUSETTS (GENERAL BYLAWS)				
<u>BY-LAW/REG.</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Title III: Article I, Sections 1 and 2	Use of Streets for Construction or Demolition Materials	Work adjacent to public ways and use of ways to place building materials or rubbish, and related application and fee requirements.	Application, permits from Board of Public Works (or Town Engineer), bond and bond requirements.	Waived, except that Applicant shall comply with all bonding requirements as required by applicable bylaw provisions
Title III: Article I, Section 20	Excavation in Streets and Sidewalks	Work in public ways, excavation and related application and fee requirements	Application, permits and fee.	Waiver of permit and 25% of fees.

<p>Town of Arlington Bylaw, Title V: Article 8 and Town Wetland Protection Regulations</p>	<p>Wetland Protection By-Law; Wetland Regulations of the Town of Arlington Conservation Commission (dated June 4, 2015)</p> <p>Arlington Wetland Protection Bylaw, Section 2 (Jurisdiction); Wetland Regulation, Sections 2(A)(5), 4(3) and 4(7) (Areas subject to jurisdiction under local bylaw/definitions of same)</p>	<p>Local Wetlands Bylaw and Related Regulations and Fees.</p> <p>Wetland Bylaw, Section 2 Wetland Regulations, Section 2(A)(5), 4(3) and 4(7)</p>	<p>Wetland Protection Bylaw, Section 2 – Jurisdiction – includes lands bordering marsh, freshwater wetland, wet meadow, bog, as a resource area protected under Bylaw.</p> <p>Wetland Regulations: Section 2(A)(5) - areas subject to jurisdiction under local bylaw include lands bordering BVW or IVW; Wetland Regulation definitions of AURA (Section 4(3)) and Areas Subject to Protection under Bylaw (Section 4(7)): locally define “AURA” as wetland resource area under Bylaw.</p>	<p>Waiver of Sections 2(A)(5), 4(3) and 4(7) to be granted by the Board from the following: Waiver of AURA as resource area: waiver to be granted as to those portions of the 100 foot buffer to bordering/isolated vegetated wetland (defined locally as Adjacent Upland Resource Area or “AURA”) which are shown within the boundary of the limit of work area depicted on the Project Plans, to allow those portions of buffer area to be graded, completed as compensatory floodplain storage, and/or emergency access, and portion of IL building all as shown on the Project Plans. No alteration to occur within 25 feet of IVW or BVW.</p> <p>For those buffer zone areas to be altered for site grading work, emergency access and/or compensatory storage, Applicant to revegetate same with non-invasive species based on generally accepted industry practice.</p> <p>Replacement vegetation to be governed by landscaping plan included with Final Plans and governed by Comprehensive Permit.</p> <p>As depicted on Site Plans, small portion of exterior emergency access and limited area of subsurface parking/building structure within limited portion of outer AURA. Waiver as to alternatives analysis.</p>
--	--	---	--	--

Thorndike Place (Arlington)

Town of Arlington Wetland Regulations (June 4, 2015)	Section 23	Land Subject to Flooding	Definitions, boundaries, criteria for permitting work within BLSF.	Waived. Limited work in floodplain to be as shown on Project Plans; floodplain compensatory storage shown thereon at ratio of 2:1, including portion of compensatory storage within buffer of vegetated wetland
Town of Arlington Wetland Regulations (June 4, 2015)	Section 24	Vegetation Removal and Replacement	Describes application process for removal of vegetation within resource areas, listing of all species existing and replacement, including specific requirements for deciduous trees, evergreen trees and shrubs.	Waived. For the portions of resource areas where vegetation is to be removed (as depicted on Project Plans/limit of work), Applicant to provide detailed revegetation of all areas not otherwise permanently altered for emergency access road or those portions of southerly side of building within floodplain "fingers" as shown on Project Plans; such revegetation plan to be consistent with generally accepted industry standards
Town of Arlington Wetland Regulations (June 4, 2015)	Section 25	Adjacent Upland Resource Area	Regulates 100-foot buffer zone, intended to allow maximum flexibility for property use while maintain protection under Bylaw	
Town of Arlington Bylaw, Title V (Regulations Upon Use of Private Property): Article 8, Section 11	Bond to Secure Flooding Conditions	Bond	Bond where structure is within 200 feet of existing stream or wetland	Waived.

Thorndike Place (Arlington)

Town of Arlington Bylaw, Title V; Article 8, Section 16.B.11	Wetlands Consultant Fees	Consultant Fees		Waived
Town of Arlington Bylaw, Title V (Regulations Upon Use of Private Property); Article 9	Placement of Dumpsters	Dumpsters or portable storage containers to be granted permit by Select Board	Dumpsters or portable storage containers to be granted permit by Select Board; permit fee of \$24.00	Waived; location of construction dumpsters/portable storage containers to be detailed within Construction Management Plan, to be submitted to Building Inspector prior to issuance of building permit. No waiver sought of \$24 fee.
Town of Arlington Bylaw, Title V (Regulations Upon Use of Private Property): Article 15, Section 1-5	Stormwater Mitigation	Stormwater Management and permitting	Procedures, applications, Engineering Division review and approval, relief from DPW	Waived. Stormwater will be managed in accordance with the MassDEP's Stormwater Policy and Technical Guidance, unless otherwise exempt. Stormwater to also be managed in accordance with a US EPA Stormwater Construction Permit for Massachusetts.
Town of Arlington Bylaw Title V (Regulations Upon Use of Private Property);, Article 16 (Art. 22, ATM 5/2/16).	Tree Protection and Preservation	Requires Tree Warden approval of tree plan prior to site work	Prior to site development, developer to identify those mature trees of diameter of 10" or more within property's legal setback yards. Trees to be removed in setback to be replaced by 2.5' caliper or payment of \$500 replacement tree.	Waived. Comprehensive Permit to include all local approvals; Applicant agrees to submit tree plan to Board prior to issuance of building permit, to designate such trees in setback area of 10" diameter or more, indicating whether replacement by 2.5' caliper tree on site or payment of \$500 to tree fund.
Town of Arlington Bylaw, Title IX: Article 3, Sections 4A, 4B	Town Fees and Charges, Department of Community Safety and Office of Building Inspector.	Fees and charges.	Payment of fees related to fire safety, building permits, plan reviews, occupancy permits, plumbing permit, gas fitting, electrical	Waiver allowing for 25% reduction of fees (reflecting 25% of project as affordable).
Water Connection Fee Regulations	Water Privilege Fee	Fee for water connections		Waiver requested of 25% of fee (reflecting 25% of project as affordable).
Sewer Privilege Fee	Sewer Privilege Fee	Fee for connection to public sewer system		Waiver requested of 25% of fee (reflecting 25% of project as affordable).

B. TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				
<u>BY-LAW/REG.</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Article 4.02	Application	Application of Zoning Bylaw	Except as herein provided, provisions of the [Zoning] Bylaw shall apply to the erection, construction, reconstruction, alteration or use of buildings, structures, use of land.	Waived; erection and construction of 12 residential duplexes and 124-unit independent living structure dwelling together with accessory uses thereto, including without limitation accessory parking (surface and garage), garden area, walking path, landscaping and management/staff office, common areas and commercial kitchen, communal dining room to be governed by Comprehensive Permit Decision.

B. TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				
<u>BY-LAW/REG.</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Article 5, Sections 5.03, 5.04	Use Regulations	Uses subject to other regulations and Table of Use Regulations (Section 5.04)	<p>Table at Section 5.04 permits as of right residential uses in PUD District: single-family detached and two family, duplex house.</p> <p>Other residential uses in PUD District, including three-family; six or more units in duplex/two-family on contiguous lots; apartment house; dormitory; licensed lodging house; rehabilitation residence; hotel/motel; townhouses are permitted via special permit.</p>	<p>No Waiver required.</p> <p>Project, as modified, includes 6 duplex buildings (12 homeownership units) and a 124-unit Independent Living apartment building (defined as Apartment House under Bylaw) principal use, with residential accessory uses (Accessory uses of off-street parking and private garage, garden/lawn, accessory management/leasing office/staff office, community spaces (library/lounge/activity rooms) and fitness facility permitted accessory</p> <p>Apartment house is allowed in PUD via special permit under Section 5.04- Table of Uses, §1.05.</p>

TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				(cont.)
BY-LAW/REG.	TITLE	DESCRIPTION	REQUIRED	PROPOSED
ARTICLE 6 – GENERAL REGULATIONS				
Article 6, Section 6.00 – Table of Dimensional and Density Regulations	Dimensional and Density Regulations	Table of Dimensional and Density Regulations	Regulates minimum lot size, frontage; maximum floor area; maximum lot coverage; min. lot area, lot depth (front, side and rear); maximum heights, minimum landscaped areas and usable open space.	Waived to allow Project to be constructed in accordance with dimensional requirements of zoning ordinance in PUD district except as waived herein and depicted on approved plans described within Comprehensive Permit decision.
Article 6- Table of Dimensional and Density (Section 6.00) (p.63 of Zoning Bylaw), and Sections 6.07, 6.12(d)(1) and 6.12(d)(2),6.28	General (Dimensional and Density) Regulations and Table; Buildings in Floodplain, Exceptions (Bonus) to Gross Floor Area Planned Unit Development Yards and Setbacks	Dimensional regulations within PUD District for lot size, floor area ratio, lot coverage, minimum yard requirements, height in PUD district; floor area density bonus for lots over 20,000 sf or for low-to-moderate income housing	PUD dimensional requirements under Table of Dimensional and Density Requirements (Section 6.00): <ul style="list-style-type: none"> • Front, Side Rear Yards – 25’ setback per Section 6.28. 	Waiver sought for front yard setback along Dorothy Road and rear yard: <ul style="list-style-type: none"> • Front yard setback of 20 feet for duplexes along Dorothy Road. • Rear yard setback associated with SW corner of IL building is 18.7 feet from rear yard, due to shape of lot. No adjacent buildable land is impacted.
Article 6- Section 6.07	Buildings in Floodplains	Dimensional and density regulations apply to buildings in floodplain together with additional regulations of Section 11.04	Includes regulations within Section 6 and Section 11.04, which includes a special permit approval process	Waived to the extent Section 11.04 requires special permit procedure and standards; project to be governed by Comprehensive Permit.

TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				(cont.)
BY-LAW/REG.	TITLE	DESCRIPTION	REQUIRED	PROPOSED
Article 6, Section 6.30	Open Space Regulations for Planned Unit Developments	Sets out minimum open space within PUD district for apartment uses	Minimum open space for apartments in PUD district is 10% landscaped/10% usable open space.	Waived as to percent of “usable open space” under Section 6.30, as such term is defined under Article 2 definition. Usable open space (<10%), as shown on Project Plans. Future trails as may be developed on open space area will also available to residents as is access path around southern side of building, both of which to be less than 25 feet in width.
Article 7, Sections 7.06 and 7.073	Signs Permitted in any B, I or PUD District	Allows for one sign for each street or parking lot frontage. No more than 2 permanent signs for any one business or industrial establishment. Allows for one directory sign of occupants/tenants. Allows for one	One sign for each street/parking lot frontage. Two permanent signs per business.	Accessory entry sign at main access drive, with additional signage to: direct residents/guests to main entrance (freestanding); direct to parking garage (freestanding); canopy sign above entrance to Independent Living building, together with wayfinding signage
<u>ARTICLE 8 – OFF STREET PARKING AND LOADING</u>				

TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				(cont.)
BY-LAW/REG.	TITLE	DESCRIPTION	REQUIRED	PROPOSED
Article 8, Section 8.01	Off Street Parking Requirements	Establishes number of off-street parking required per use	<p>Section 8.0: One space per efficiency; 1.15 per one-bedroom unit; 1.5 per two-bedroom unit; and 2 per three-bedroom unit. Per Zoning Bylaw, Assisted Living requires .4 parking spaces per unit; Arlington zoning bylaw has no established parking ratio for Independent Senior Living.</p> <p>Section 8.01: Allows for up to 25% reduction via special permit in parking in multifamily zones (R5, R6) where 3 TDMs or more are proposed</p>	<p>Waived; to allow for 96 total parking spaces for Independent Living as shown on Project Plans, which includes 12 exterior parking spaces and 84 garage parking spaces. [96 spaces of IL parking amounts to parking ratio of .77 space/unit. Parking supply satisfies standards of ITE Parking Manual, 5th edition for Use Code 252.</p>
Article 8, Section 8.12.(11)	Parking/Loading space standards	Allows up to 20% of parking spaces to be compact by special permit	Allows up to 20% of parking spaces to be compact by special permit	<p>Waived - to allow up to 24 compact spaces (designed as 8.5' x 18') in garage parking (approx. 25% of total parking.</p> <p>Note 1: The "compact" spaces per the project plans are compact only as to width (8'), but provide the length (18') as if a standard space.</p> <p>Note 2: The project's garage parking also provides surplus HC spaces (8 garage spaces) together with 2 exterior HC spaces, to accommodate elder drivers.</p>
ARTICLE 10: ADMINISTRATION AND ENFORCEMENT				

TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				
				(cont.)
BY-LAW/REG.	TITLE	DESCRIPTION	REQUIRED	PROPOSED
Article 10, Section 10.02	Permit Required	Permits issued only in compliance with zoning bylaw.	No permit shall be issued if the building, structure or lot as constructed or used would be in violation of any provision of the Bylaw	Waived - Construction and use of buildings and land be in accordance with the Comprehensive Permit decision.
ARTICLE 11 SPECIAL REGULATIONS				
Article 11, Section 11.04(a)-(g)	Floodplain District	Governing regulations and special permit review by ZBA/ARB	Permit required for specific uses and structures; seeks to require compliance with Sections 11.04 and 11.05 of Bylaw and Wetlands Protection Bylaw (Title V, Art. 8 of Town Bylaws), in addition to State Law (MGL 131, 40) and State Regulations (310 CR 10.00) and State Building Code. Establishes special permit process for new buildings or earth movement in floodplain.	Waived for special permit process/environmental design review and waiver of application of local wetlands bylaw (Title 5 of Article 8), rules or regulations and Section 11.05 of Zoning Bylaw. Project to be governed by Comprehensive Permit.
Article 11, Section 11.05(b), (d), (e), (f)	Inland Wetland District	Permit required for specific uses and structures.	Special Permit required for specific uses and structures.	Waived. To extent portions of property are within district, waiver given as Project governed by Comprehensive Permit. (Included for informational purposes - per ch. 40B, waivers are not required for special permit uses).

TOWN OF ARLINGTON ZONING BYLAWS (AS AMENDED THROUGH APRIL 2015)				(cont.)
BY-LAW/REG.	TITLE	DESCRIPTION	REQUIRED	PROPOSED
Article 11, Section 11.06(b), Section 11.06(c), Section 11.06(d), and 11.06(e) and 11.06(f)	Environmental Design Review	Environmental design review and standards for projects including six or more dwelling units (11.06(b)(1)(b) or use within a PUD (Section 11.06(b)(2).	Uses subject to Section 11.06(b) may be allowed subject to special permit upon application to ARB to include materials set out in Section 11.06(d) as well as certified land surveyor survey plan of land and corner points of lot to be marked by monument or other physical demarcation. Before special permit to issue, public hearing before ARB. Review standards as contained in Section 11.06(f).	Process Waiver - Environmental Design Review (EDR), special permit application submittal, standards, procedures and hearings before ARB. Waived including waiver from adherence to EDR submittal requirements of Section 11.06(d) and review standards of Section 11.06(e)/(f). Waiver of sign applications; signage to be depicted on final approved site plans, with exception of temporary construction signage as approved by Building Official from time of commencement of project to completion of construction. Project to be governed by Comprehensive Permit decision.
Article 11, Section 11.08	Affordable Housing Requirements	Affordable housing requirements for projects including six or more residential units under Section 11.06	Requires 15% of new residential units be Affordable Units (as defined in Zoning Bylaw, Section 11.08), or contribution to Affordable Housing Trust Fund, by allowance of ARB	Waiver to the extent Section 11.08 varies or is not consistent with Chapter 40B, its regulations and the rules and policies of DHCD and MassHousing. Applicant's project is subject to affordable housing requirements as contained in M.G.L. c.40B and its regulations under the New England Fund Program of Home Loan Bank of Boston, in accordance with Site Approval given by MassHousing and Regulatory Agreement approved by the State. Project to provide 25% of units to be available to low and moderate income families (80% AMI)

ZONING BOARD OF APPEALS OF TOWN OF ARLINGTON COMPREHENSIVE PERMIT REGULATIONS				
<u>REGULATION</u>	<u>TITLE</u>	<u>DESCRIPTION</u>	<u>REQUIRED</u>	<u>PROPOSED</u>
Section 3.1, 3.2	Application and Documentation	Application contents	Complete application filed upon submittal of documentation of Section 3.0	Waiver of certain submission requirements beyond the scope and requirements of 760 CMR 56.00 at time of initial filing; additional documentation and information was submitted to Board within public hearing process. .



Town of Arlington, Massachusetts

Thorndike Place - New Photos

ATTACHMENTS:

	Type	File Name	Description
▢	Reference Material	Pic1.pdf	Pic1
▢	Reference Material	Pic2.pdf	Pic2
▢	Reference Material	Pic3.pdf	Pic3





